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ORIGINAL ARTICLES

A RESUMÉ OF FOUR YEARS OF STUDY AT THE GOOD SAMARITAN (ENDOCRINE) CLINIC WITH SPECIAL REFERENCE TO SEVEN HUNDRED X-RAY HAND PICTURES AND THEIR RELATION TO GENERAL BONE PROGRESS*

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TWO years ago we reported from the Good Samaritan Clinic,[1] of Atlanta, a study of six hundred people in which there seemed a definite connection, or correlation, between the body and jaw growth. Since that time, six hundred other people have had the same survey and our conclusions, though few, seem to justify an additional report. This survey, as did the former, represents the work of twenty-nine physicians and three dentists. This group has made routine examinations of the whole body and every department of medicine and dentistry has been employed. In making this study of body growth several outstanding and interesting physical phenomena seem to justify our original position that body growth and jaw growth are dependent upon and progress under the same influence.

In one instance our opinion of two years ago was not entirely borne out. Disproportions of bony measurements and malformed jaws were not definitely correlated in the further observation. Taking the six hundred cases studied up to that time as a basis for a tentative opinion, we said, "The torso measurements of an infant, if normal, are in excess of the leg, or long measurement. In short, the body is much longer than the legs. (Fig. 4.) At some time in life, possibly by the age of puberty and certainly by ma-

*Presented before the Alumni Society of the Dewey School of Orthodontia, August 29, 1927, New York City.

turity these two measurements should become equal. In fairness to a 'normal variation' we have allowed, in postadolescence, the difference of two inches between the leg and body measurements. In more than one hundred and fifty cases, representing both pre- and postadolescent individuals, there was found an abnormal disproportion of the torso and long bone measurements; and some presenting as much as seven inches in favor of the leg measurements. All of these cases have presented a malformation of jaws and arches.'' Our series of twelve hundred cases studied up to the present time do not justify the assertion that body disproportion and jaw growth are definitely connected.

However, we have been interested to see corroborated the position formerly taken as to acromegaly, obesity due to posterior-lobe pituitary deficiency, and mongolianism.

Up to the present writing there have been only nine classical cases of acromegaly to come under our observation. These were studied in both private and clinic work. We use the word classical to convey the idea that only advanced symptoms are pictured in textbooks with chapters on acromegaly. However, additional literature seems to substantiate theories on potential acromegalics expressed in our last report.

We stated in part that ''most authorities contend that acromegaly never makes its appearance until after maturity, and they explain that it is a sequence of gigantism. It is our opinion that this cryptic disease may and does make its appearance in preadolescent individuals. It is also believed that the medical world fails to recognize the young cases because, in youthful subjects, its manifestations are limited to an unobstructive mesioclusion. A study of the development of the hands and feet in young children would be exceedingly difficult. An anterior relationship of the mandibular teeth to the maxillary should always be accepted as a possible correlation and its treatment approached with a full comprehension of possible failure.'' In a recent article[2] Davidoff reported one hundred cases of acromegaly and there were included in this report two cases of preadolescent age.

This lends weight to that portion of the previous quotation in which we suggested that all anterior protrusions of the mandible should be viewed with suspicion as a possible correlated problem. It might be repeated that certain individuals present a *mild form* of acromegaly, or for the lack of a better term a ''potential acromegalic tendency,'' and it is that patient which may seek orthodontic services rather than medical. Orthodontists will agree that at least some of their cases presenting a protrusion of the lower jaw have failed to respond to mechanical influences. Recently a valuable contribution[3] was presented before the American Society of Orthodontists in which the author stated that certain cases similar in appearance and treated in the same way did not respond to identical therapy.

Work on the part of Evans[4] seems to have placed the responsibility of bone growth on the anterior lobe of the pituitary body. His laboratory findings in which he produced gigantism in rats by the use of the extract of the anterior lobe of the pituitary gland should be accepted. His scientific contribution was a stimulus to our efforts in this study.

OBESITY AND JAW DEVELOPMENT

Obesity is as interesting as it is unfortunate. Both men and women are subject, for various reasons, to this handicap. They seek all kinds of aid; medical, lay-advised, exercise and diet, and many different cults which make unproved claims.

Until the internal secretory influence upon all body development was recognized, all "fat people" were considered dietetic and sedentary, but an understanding of glandular function seems to establish several types of the obese as follows: dietetic, posterior-lobe pituitary deficiency, thyroid deficiency, gonad deficiency, and mixed glandular deficiencies.

At the beginning of this survey of body correlation we sought to divide the types of obesity into four great groups; namely, posterior lobe of the pituitary gland, thyroid, gonad, and nonglandular obesities. In this discussion we shall describe only the main differences between the cases which presented pituitary and thyroid overweight.

There are four principal differences in these two types and these are so easily differentiated that mere mention of them will suffice. These are: the general appearance of the body as regards contours, general distribution of fat and localized adiposities; the mentality of the patient, elicited both by direct conversation and facial expression; the metabolic reading; the growth and type of hair; character of the skin and a general survey of the extremities. When these simple examinations are made, the difference in these two types is usually clearly made out.

In the pituitary obesity there is a sharp contrast to the thyroid in the distribution of fat, for in this type (pituitary) we find the localized paddings with a retention of all main contours of the body. Given a case of a young or middle-aged adult, in both instances we find a very fat person, but in the pituitary type we have the girdle contour ("hip padding"), the calf and ankle contour, the neck contour, maintained regardless of the amount of overweight. These cases also show an enormous hip padding, called by Engelbach,[5] the "trochanter obesity." The thyroid type, although the same age and the same weight, will show almost an entire obliteration of body contours and present a fat person "straight up and down." This difference can, of course, be noticed if the patient is stripped and inspected.

Another interesting, but important, difference is found in the mentality of these individuals. In the pituitary group we find usually a normal mind. In the thyroid group there is manifested the dull, lethargic person who cares little whether he is fat or not. The pituitary case also usually shows fine and normally oily hair while the thyroid case presents coarse and dry hair. The skin of the thyroid type is thick and dry; in the other, normal.

We believe that the basal metabolic reading has a real place in this differentiation because it has so consistently coincided with clinical findings. In other fields it has not been taken so seriously because of the lack of this correlation.

In all obese patients in the thyroid group there should be a definitely minus reading, and, in our opinion, there will be, if the cooperation of the patient is good and the technic accurate.

Fig. 1. Fig. 2. Fig. 3.

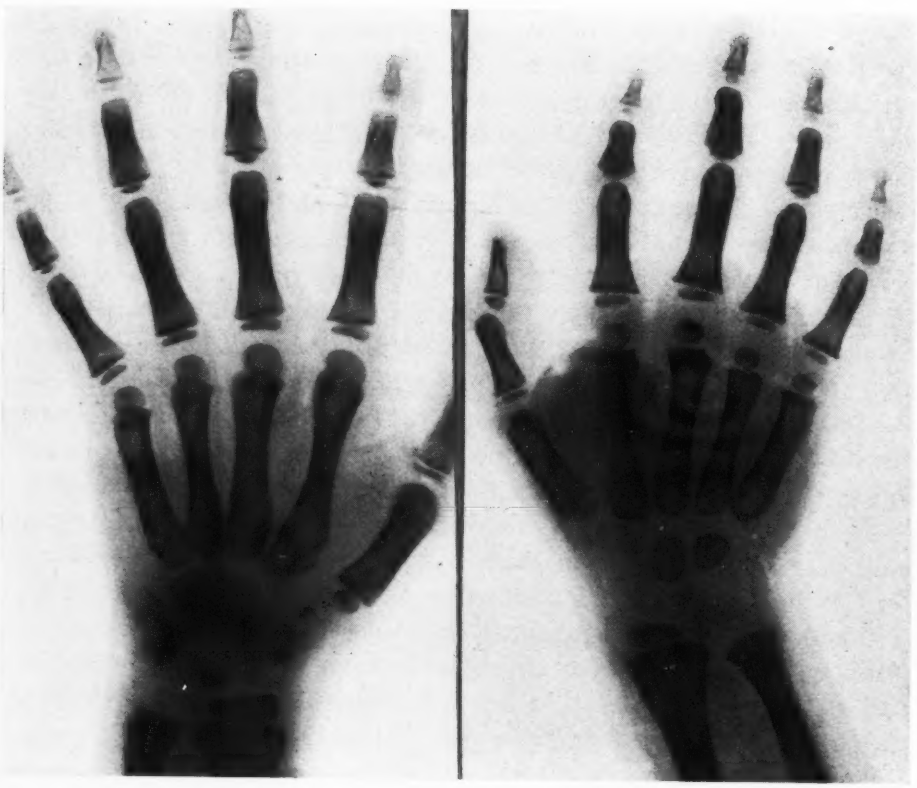

Fig. 4. Fig. 5.

Fig. 6.

Fig. 7.

Fig. 8.

Fig. 9.

Fig. 10.

Fig. 11.

Fig. 12.

Fig. 13.

Fig. 1, Case No. (C. C. H.), age four, male, shows a "normal" physiologic hand for its chronologic age. There are four carpal bones present as well as the epiphysis of the radius and all epiphyses of the metacarpals and phalanges. Compare Fig. 2, Case No. C. C. H., male, age four, and Fig. 3, Case No. 817, female, age four. Fig. 2 presents six carpals while Fig. 3 presents seven.

Fig. 4, Case No. 1132, female, age five, presents a normal hand with six carpals. Fig. 5, Case No. 685, male, age five, shows only two carpals—a hand resembling that of a child of about two years of age; undoubtedly retarded.

Fig. 6, Case No. 531, female, age six, shows a normal hand with seven carpals and the presence of the epiphysis of the ulna. Compare with Fig. 7, Case No. 830, female, age six, and note the delayed progress. This hand resembles that of a child six months of age. Note the complete absence of all the epiphyses of the metacarpals and phalanges. A very unusual retardation.

Fig. 8, Case No. 176, female, age seven, hand is normal. Fig. 9, Case No. 734, male, age seven, hand is also about normal for sex. This comparison illustrates the normal advancement of bone progress of the female over the male.

Fig. 10, Case No. 969, female, age 8, hand is normal. Compare Fig. 11, Case No. 677, male, age eight. This hand is very retarded with only two carpals and two epiphyses of the phalanges. The epiphysis of the radius has just begun to form. The chronologic age of this child might be judged as being one year instead of eight.

Fig. 12, Case No. 665, male, age nine, hand is normal. The semilunar seems to have two osseous centers. Compare Fig. 13, Case No. 993, male, age nine, and note the retarded progress, there being only three carpals and the absence of the epiphysis of the ulna.

Fig. 14, Case No. 618, male, age ten, normal hand with seven carpals, while Fig. 15, Case No. 543-A, female, age ten, presents the pisiform or eighth carpal, probably advanced.

Fig. 16, Case No. 609, male, age eleven, and Fig. 17, Case No. 616, female, age eleven, demonstrate the normal advancement of bone progress in the female. The male having seven carpals and the female eight. We were unable to find any eleven-year-old hand showing a variation.

Fig. 18, Case No. 590, female, age twelve, shows normal hand for this age. Compare Fig. 19, Case No. 996, female, age twelve, and note the almost complete closure of spaces between the epiphyses of the ulna and radius. According to Cohn this should not take place before the age of eighteen. The epiphyses of all the metacarpals and phalanges have also about united with their respective shafts. This is not supposed to occur before the age of fifteen, therefore, this case, Fig. 19, is osteogenetically advanced for her chronologic age.

Fig. 20, Case No. 746, female, age fourteen, normal. Note the well-formed pisiform and that all of the twenty-one epiphyses are separated from their respective long bones. Compare Fig. 21, Case No. 576, female, age fourteen. The epiphyseal unions of the metacarpals and phalanges are completely ossified. The ulna and radial epiphyseal openings are nearly closed. An accelerated bone progress.

Fig. 22, Case No. 542, female, age fifteen, presents a normal hand for this age. Compare Fig. 23, Case No. 239, female, also age fifteen, and note the complete closure of the openings between the epiphyses and the ulna and radius. This should not occur before eighteen years. The union of the epiphyses of all the carpals and phalanges should be closed about the age of fifteen.

Fig. 24, Case No. 1118, female, age eighteen, shows complete osseous union of all the twenty-one epiphyses to their respective long bone; this being typical of normal adult hands. Compare with Fig. 25, Case No. 916, male, age thirty, and note the very delayed union between all epiphyses and their respective long bones. This case was an extreme hypogonad individual.

Fig. 14.

Fig. 15.

Fig. 16.

Fig. 17.

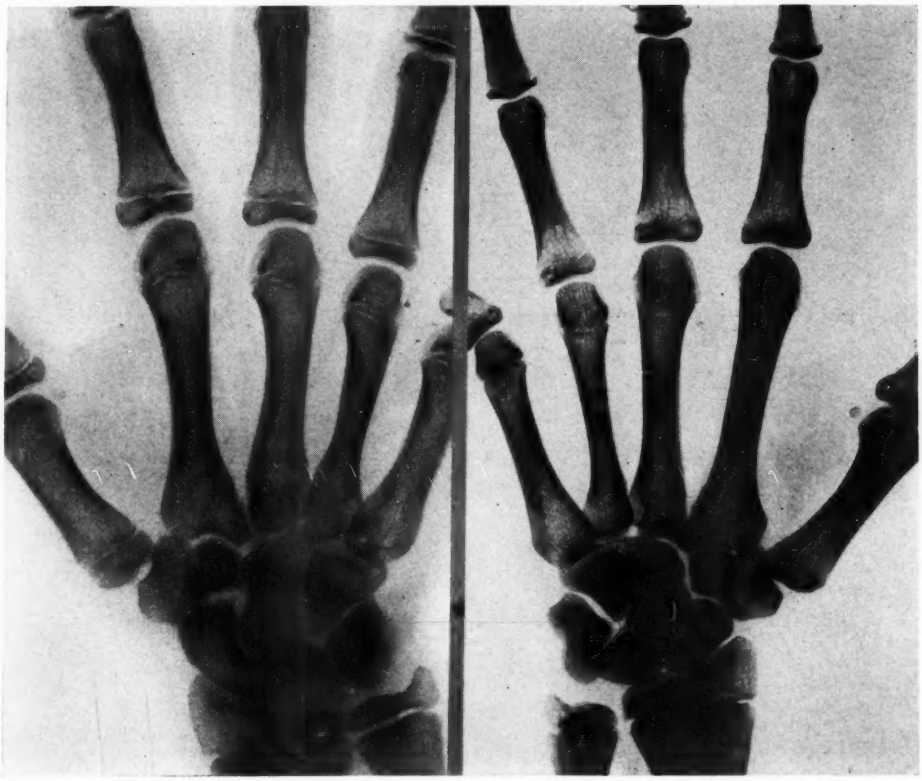

Fig. 18.

Fig. 19.

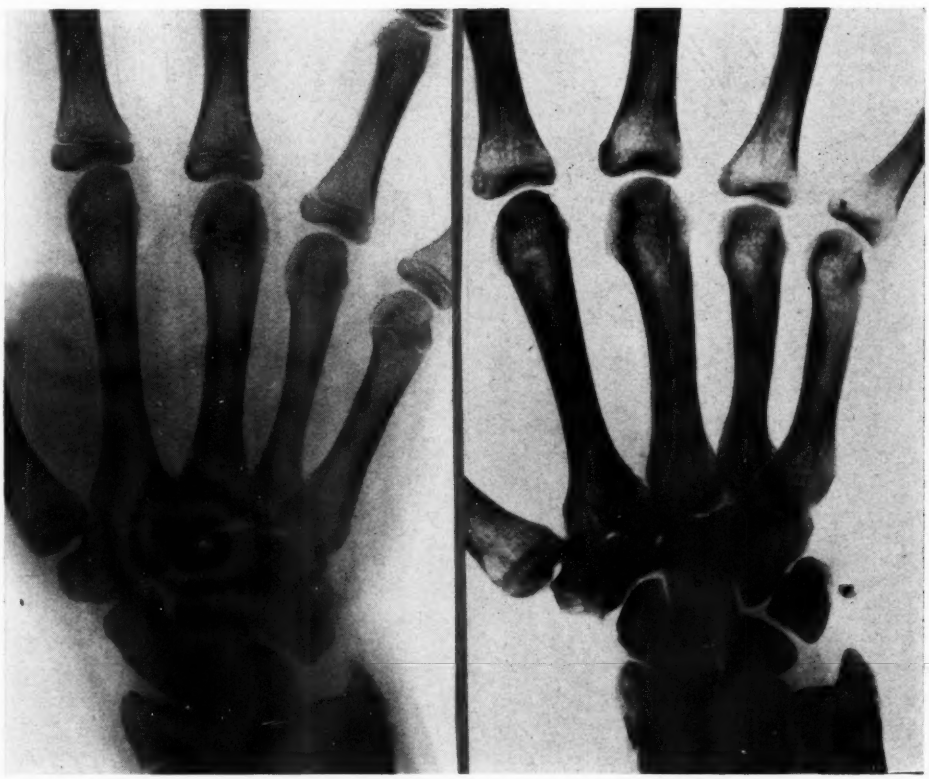

Fig. 20.

Fig. 21.

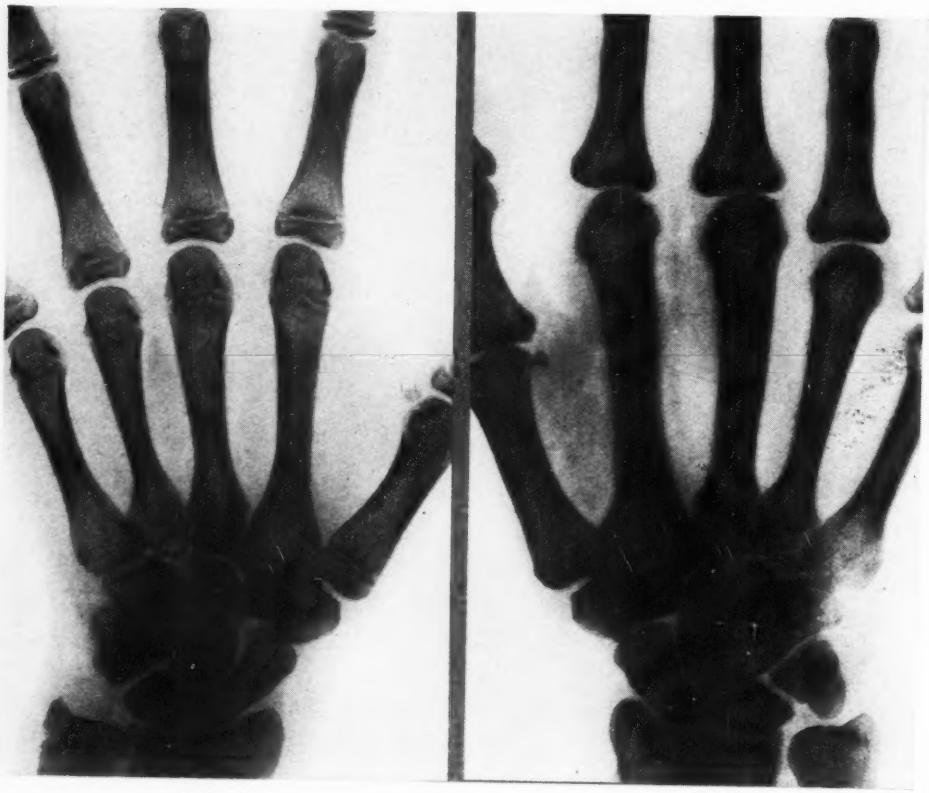

Fig. 22.

Fig. 23.

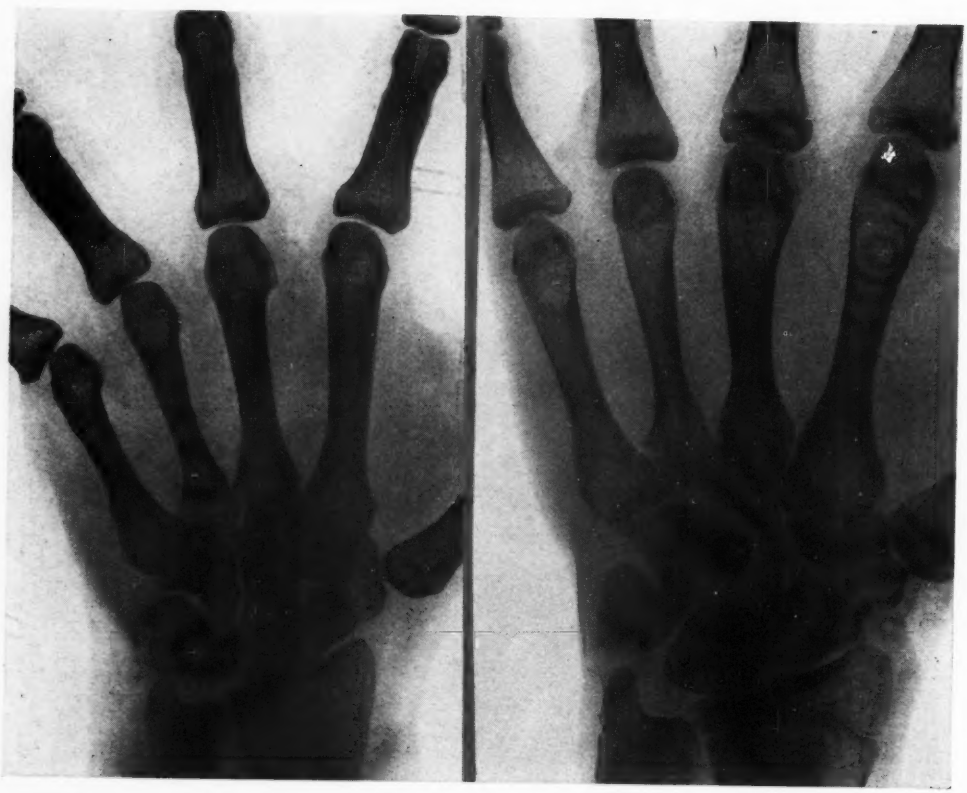

Fig. 24.

Fig. 25.

In the pituitary type we have found the reading to be within the normal limits, that is, from minus 10 to plus 10.

Another thing to consider in these readings is that minus readings are much more accurate than plus readings because so much depends upon the patient in the matter of cooperation and any lack of cooperation on the patient's part would run the reading higher. Therefore, with a definite low reading it must be assumed that it is, at least, correctly reported, and if there should be any modification, it would be to raise it and not lower it. This much cannot be said for plus readings. As above stated, this is regarded only in the light of clinical evidence and as corroborative testimony.

In these cases we attempted to prove our study by putting them on either pituitrin or thyroid extract, and it is interesting to note in establishing a tolerance to either product how much of either some individuals can take. As a routine, therefore, we establish this tolerance really as a part of the diagnosis.

We believe it to be a mistake to select an arbitrary dose of thyroid, for instance, and keep up the same dose indefinitely. The reason for this opinion is that the dose may be an infinitesimal one compared with what the individual could really take. Therefore, we begin all tolerance tests by starting the patient on one-tenth of one grain three times daily and increase the dose one to two or three tenths daily until a tolerance is reached. This is clearly manifested by the usual signs of thyrotoxicosis. Some cases will be found that can consume an enormous dose daily. We recall one case, a girl fourteen years of age, who did not reach her tolerance until she had taken forty-eight grains daily. The dose was then reduced to just below the amount and she made a noticeable improvement. Finally, her tolerance was lowered and we were compelled then to reduce the thyroid just as we had increased it, showing, at least theoretically, that the gland had been stimulated to some action. We use always an American product.

The pituitrin, or better, the posterior-lobe tolerance is established on the same principle. We usually start by giving one-fourth of a c.c. and gradually increase this daily until the tolerance is manifested. This is just as characteristic as the thyroid effect and is shown first by a paling of the skin accompanied by an intestinal tenesmus. Blood-pressure readings may be made during this time, but the change in the pressure is variable. The patient should be observed for at least a half hour after the injection, as sometimes the action is delayed and these symptoms may come on unexpectedly to the embarrassment of the patient. When this tolerance is clearly established, we drop the dose, just as with the thyroid, and continue treatment, being governed in the future by the physiologic action of the product. In one case we were able to give as much as 8 c.c. of posterior lobe extract without even the tenesmus and obtained a satisfactory result.

When one has clearly differentiated these two very interesting and yet troublesome problems and will not hesitate to establish an exact tolerance to the product he is using, we believe that much can be accomplished in the reduction of some fat people who have hitherto starved themselves to

the point of suffering and exercised themselves to the point of fatigue without any result except a gain in weight. In these types a special diet is not necessary. Exercise may or may not be taken.

Assuming that the thyroid deficiency causes obesity and that deficiency of the posterior lobe of the pituitary gland does the same thing, we quote from our article of January, 1926, INTERNATIONAL JOURNAL OF ORTHODONTIA, ORAL SURGERY AND RADIOGRAPHY, as follows:

"In our examination of over six hundred cases, a positive diagnosis of hypoposterior-lobe obesities was made in forty-one patients. These people vary in age from ten to thirty years. The torso and long bone measurements were normal in every case and without attempting an explanation, the arch and jaw development was normal in all respects. (Fig. 10.)

"It should be extremely interesting to the general practitioner to know that this type of obese individual has in every case presented teeth almost 100 per cent free from caries and with gum tissue in the pink of condition. It might be added that at least half of the total number examined volunteered the information that they had never owned a toothbrush. Normal occlusion and normal function could not have prevented decay of the teeth and disease of the soft tissue, in our opinion, any more than an abnormally functioning heart could be responsible for a gallstone." We have now seen over eighty of these cases with body measurements, jaw growth, and fat paddings constant.

MONGOLIANISM

The reason for this condition has never been described. The appearance of the individual is typical and the hopelessness of the situation long understood—a matter of a helpless idiot, unheeded.

We have seen thirty cases out of 1200 examined, and in their anatomic organization a most interesting and constant phenomenon has been noted by the orthodontic department, showing that in addition to the characteristic facial, mental, and body markings, a mouth condition is invariable.

Congenitally absent teeth in both temporary and permanent sets are constant. The contours of the upper dental arch are angular in form. The soft tissues, lingual to the teeth, describe a horizontal plane of from ⅛ to ¼ of an inch, and at an abrupt angle the vault ascends. This peculiar anomaly presents an angular arch without usual contours.

The dorsal surface of the tongue in every one of these cases presented fissures without inflammatory areas.

BONE PROGRESS OF THE HAND

As a part of routine, x-ray hand pictures are made of each patient. We are grateful to Dr. James J. Clark, Professor of Roentgenology, Emory University, for the valuable service he rendered.

We have completed a systematic survey of seven hundred hand pictures and have tabulated with each hand picture the patient's torso and long bone measurements, the jaw and arch survey and medical diagnosis.

The medical and orthodontic professions should be interested in this study because of the large number of ossification centers which appear at intervals from birth to maturity. At birth all long bones of the hand as well as the ulna and radius, are present. Beginning about the sixth month after birth three centers appear, the os-magnum, the unciform, and the epiphysis of the radius. During the second year the cuneiform appears; then successively up to the seventh year appears the semilunar, scaphoid, trapezoid, trapezium. About the sixth year the epiphysis of the ulna appears. By the third year the osseous centers of all the epiphyses of the metacarpals and phalanges appear. There are nineteen of these. Between the ages of ten and fourteen, depending upon sex, the female being in advance of the male from birth to maturity,[6] the remaining or eighth carpus, namely the pisiform, presents its center of ossification.

In addition to the appearance of these twenty-nine centers for study, there are several other osteologic changes which occur at different intervals during the period of adolescence. The two most definite changes occur at the ages of fifteen and eighteen years. The diatheses of the epiphyses of the metacarpals and phalanges normally close about the fifteenth year. That of the ulna and radius from the eighteenth to twenty-first year, which also varies with sex.

You will see from the above that the orthodontist and pediatrician have a remarkable and yet condensed field of study in determining the progress of bone growth.

Such objective centers of study will elicit proper interest in child growth should the x-ray, in determining the status of bone progress, be more generally used. For example the epiphyses of the ulna and radius take on certain dimensions of growth as age progresses. The downward projection of their respective styloid processes gives definite information concerning growth progress.

The relative size of the ulna and radial epiphyses to that of their parent bones has been made a part of the study.

The space between the epiphyses and their respective long bones diminishes with age and finally completely closes. A definite technic must be followed in x-raying hands or otherwise a later comparative study would be of little value.

Before directing attention to our summary of seven hundred hand pictures we quote a part of the "foreword" of Cohn's, "Normal Bones and Joints." This foreword was written by the eminent surgeon and scholar, Rudolph Matas. He says: "With the advent of the roentgen rays and of a constantly improving technic the study of growing bones has been completely transformed. Not only have the opportunities for this study been vastly increased by the inexhaustible supply of normal living material, but it has been enormously facilitated and simplified by the roentgenographic process. This study has also been improved by the greater accuracy of the roentgenogram, through which the earliest ossific deposits in the translucent epiphyses of human embryos 32 mm. long can be detected at an estimated

age of nine weeks (Pryor), long before these can be recognized in gross anatomic preparation, unless supplemented by a tedious and laborious microscopic research. The enormous advantage of this mode of recording the progress of developmental ossification is too obvious to be dwelt upon."

As a matter of historical information, he further states:

"In 1896, Bade (Munich) wrote on the development of bones of the foot exhibited in roentgenograms. In 1898, Poland (London) published his great treatise on the 'Traumatic Separation of Epiphyses' based on his roentgen-ray studies of the growing skeleton, in which the normal and pathologic anatomy of the epiphyses in their surgical relations are fully described. This work, together with a small roentgen atlas showing the development of the wrist and hand, is an epochal contribution and lasting memorial to the scientific initiative and enterprise of this distinguished surgeon, as it was produced at a time when the technic of roentgenology was still in its infancy. In 1898, Ranke (Munich) published a paper on the ossifications of the hand as seen with the roentgen rays. In 1899, A. Hahn published a monograph on the deficiency or congenital aplasia of the epiphyses and its effect in stunting the growth and development of the skeleton. But this is not all, for in roentgenology the modern anthropologist has also found an invaluable aid in determining the age of the individual by a study of the chronology of epiphyseal ossification. The anthropologist in the preroentgen period depended upon the anatomic scale of ossification which had been established by the methods of gross anatomic preparations. Now, a vast amount of material has been investigated in the living subject by the searching light of roentgenology, and the age of fusion of the various epiphyses within themselves and with the shaft or body of the bone has been determined by the average of an immense number of roentgenographic records. It is seen by this cursory review of the activities of roentgenologists in this restricted and highly specialized department of anatomy and developmental morphology, that the ground work for a comprehensive roentgenologic study, from the embryo to maturity has been well laid."

No priority is claimed in the study of bone growth by means of the x-ray. Should this presentation stimulate, however, a channel of thought which will, even in a small way, clear up some of the present intangible problems of etiology, we shall feel justified.

Applicants at the Good Samaritan Clinic are thought to be abnormal people. We have, however, through this source been able to select a normal hand picture to correspond to all chronologic ages as described by Cohn.[7] The illustrations describe the study. Attention is called, however, to the omission of pictures showing variations from the supposed normal before the age of four years. In fact, and for practical purposes a comparative study, previous to the age of four seems unnecessary. Medical study of children is of general interest from birth.*

In describing the illustrations the word "normal" is used figuratively.

*The original paper contained thirty-three additional illustrations. The complete paper will be furnished by the authors if requested.

JAW AND HAND GROWTH

From the seven hundred hand pictures studied, there were found only 64 presenting definite osteogenetic abnormalities. Several hundred were adults and the remaining number were physiologic according to our basis of study. It should be of particular interest to orthodontists to know that of the sixty-four abnormal hands forty-five showed advancement in bone progress and twenty-nine of these presented normal jaws and arches; nine were of neutroclusion, three were anterior occlusions, and four were posterior occlusions of the mandible.

There were nineteen cases of definite retarded bone progress; sixteen of these presented a malocclusion responsible to a malgrowth of the jaws and arches, the remaining three being normal.

THE VALUE OF ROUTINE HAND STUDY

There are several groups of malformations of the jaws and arches and into these groups fall two types of malocclusion which result from separate sources. One is of local origin and presents a simple derangement of teeth due to some perverted mechanical influence. The second group, and by far the most interesting, is the result of a perversion of growth involving the body of the maxillae and mandible. This anomaly is in our opinion associated with, and partly responsible to, a general metabolic imbalance. These are the cases which are most frequently referred to the so-called expert. His procedure is in a general way about as follows: record models and possibly photographs for study—x-ray the entire mouth for whatever may be found. A meager history concerning adenoids and tonsils, habits, past illnesses, and perhaps a word about dietetics. Interest usually becomes unfortunately local and appliances and their arrangement are paramount in future contact with the case. Hopes of rendering a cure are circumscribed by an abiding faith in mechanical pressures for producing or creating bone growth. If by good fortune the patient is in the state of general growth the results may terminate satisfactorily. One may honestly believe that the jaw growth which occurred during treatment was obtained because of the manipulation of appliances, but the sad story, so seldom seen in print, is that another case similar to the "successful" one, although under treatment for years and with teeth moved to a better functional occlusion, may show the body of the jaws to have failed to grow to any appreciable degree.

We believe that no case with a definite jaw malformation should be placed under orthodontic treatment before a knowledge of the child's growth-progress is established. It has been stated[8] that no two children grow alike or in the same ratio according to age. It also seems that child growth is not continuous, but nature provides her own "rest periods" which may continue not only for months but even years. Our records at the clinic appear to substantiate this fact.

Our hand studies may prove nothing for a correlated value, but offer to medicine and orthodontia a remarkable field of study in determining general bone growth. In brief, we would advise the following plan of procedure *before* orthodontic treatment is begun. After making preliminary records, the

weight and height should be recorded. The status of the carpals and epiphyses of the hand (both hands should be x-rayed on an 8″ x 10″ film) should be obtained. The parent should be advised that the child's problem is one of growth and that no appreciable growth can be created by means of mechanical pressures. However, if the growth processes are active throughout the skeletal framework, then mechanical stimulation may influence the direction of growth. The patient should return in four months for a second study. A comparison of height, weight, and the comparison of a second hand picture will give information which may determine the most advantageous time for treatment.

No one will deny the value of correlated study on any subject. Some may wonder why one interested in the endocrines and another in orthodontia should combine their efforts in observing the physical make-up, its functions, developments and departures from normalcy. To compute the value of mutual study, one has but to review any such compilation to be convinced of mutual benefit.

The authors of this paper have endeavored to learn whether or not the body grew and developed as directed by a common influence. To study the mouth and its progress together with the general body growth seemed to be the most practical method, since definite growth changes occur in the jaws during infancy.

This report, the result of four and a half years' investigation, seems to justify the opinion that the whole body, as a growing entity, should be studied as a common machine. The two professions have not linked together their forces sufficiently in the past.

To find types of "fat people" who have had in our study normal mouths, both in jaw growth and tooth preservation, may or may not mean anything; the study of mongolians, whose mouths are classical, may not be of value—and even all work done on bone growth may appear sophomoric in a comparatively short time. However, the fact remains that the study of the child in its formation period has been neglected. All factors and forces should unite in the common purpose of producing the normal—the body perfect.

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20 DOCTORS BUILDING.

THE PALAEOMORPHOLOGY OF THE HUMAN HEAD: TEN STRUCTURAL STAGES FROM FISH TO MAN. PART I. THE SKULL IN NORMA LATERALIS*

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THE human head is always of special interest to anthropologists, who have measured and classified its varieties all over the world. But what is the human head, where did it come from and by what steps did it arise? The purpose of the present paper is to trace, so far as possible from available evidence, ten structural stages in the evolution of the vertebrate head from fish to man.

MORPHOLOGY OF THE SKULL IN FISH

In the Lower Devonian rocks of Great Britain, Russia and Canada, one finds the remote ancestors and relatives of the lobe-finned or crossopterygian fishes and of the dipnoans. The intensive studies of Pander, Traquair, D. M. S. Watson, Bryant and others in the structure of these fossil fishes have led to the now widely accepted conclusion that while neither the lobe-finned nor the dipnoan fishes are the direct ancestors of the land-living vertebrates, both are closely related to the still undiscovered tetrapod stem. On the whole, it is agreed, the lobe-finned fishes of the Devonian give us a fairly close picture of the morphology of the skull in the stage immediately preceding the emergence of swamp and land-living vertebrates.

The head, even of these primitive fishes, is already a highly developed structure. The skull consists essentially of internal or endocranial elements overlain by ganoine-covered surface bones, the latter being of the same nature as the scales on the body. The endocranium includes first, the bony capsules surrounding the nose, eyes and internal ears, and secondly, the bony trough that encloses the brain itself. As to the evolutionary history of the endocranium, considerable progress has been made in recent decades, but the present and following papers are concerned principally with the history of the dermocranium or surface skull.

In these primitive fishes (Fig. 1, I) the dermocranium included the following series of elements: (1) roof bones on or near the mid-dorsal line, covering the nose, eyes, pineal organ and hind brain; (2) the maxillary series, including the premaxillae and maxillae of the upper jaw and the dentary or inferior maxillary of the lower jaw; (3) the circumorbital series of five plates around the eye; (4) the temporomandibular series; in the skull these plates, consisting chiefly of the squamosal and quadratojugal bones, cover the temporal region; they protect the upper jaw muscles and the back part of the

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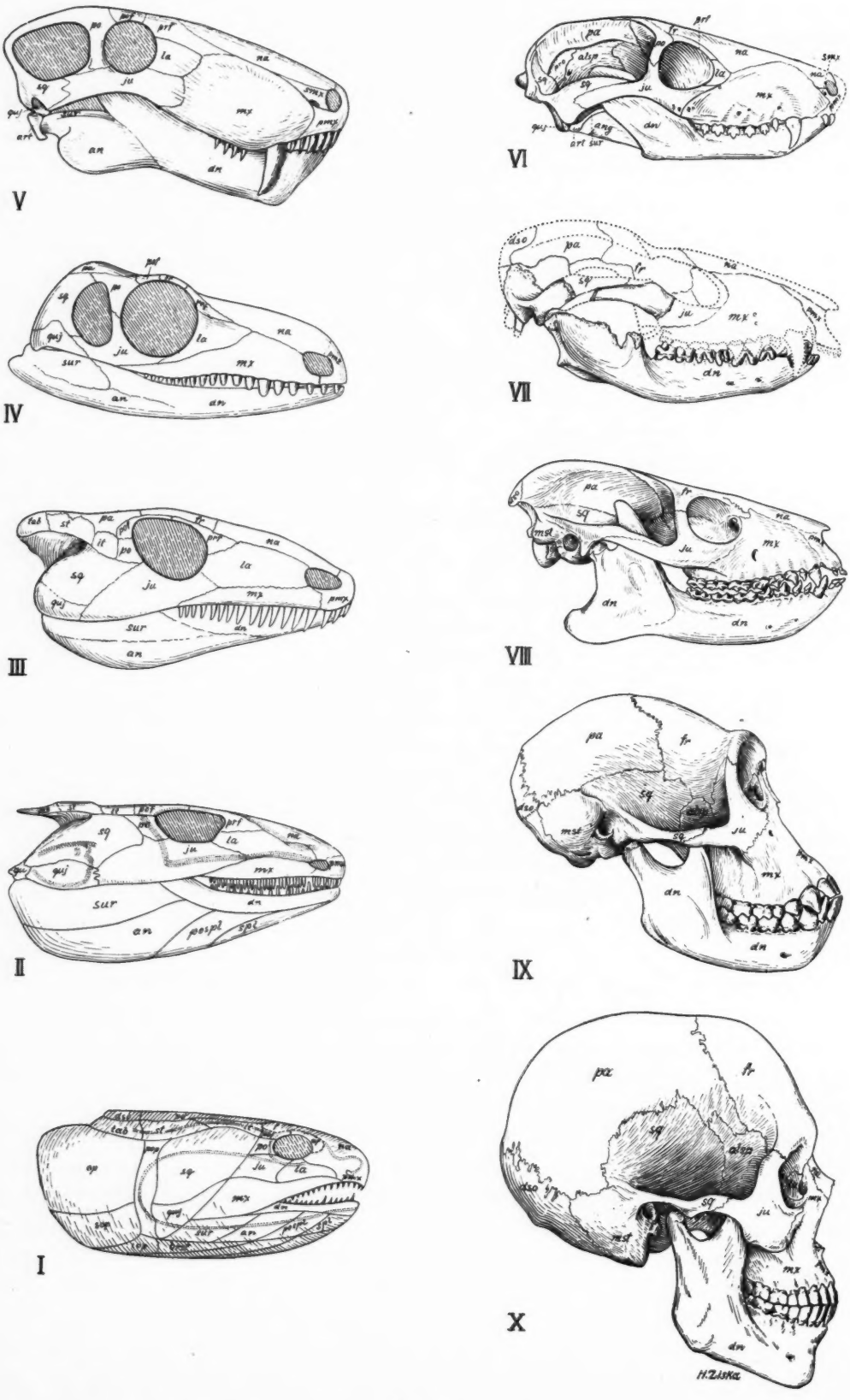

Fig. 1.

primary upper jaw or pterygoquadrate. In the lower jaw this series includes the plates lying immediately behind and beneath the dentary, namely, the infradentaries or splenial, postsplenial, surangular; (5) the opercular series, covering the branchial chamber and the floor of the mouth.

AMPHIBIANS

The oldest known stage of the tetrapods or higher vertebrates is that of the amphibians of the Lower Coal Measures of England. Described very imperfectly by earlier authors, they have recently been restudied and redescribed by Professor D. M. S. Watson of the University of London, in a memoir of the greatest importance to all students of the evolution of the vertebrates. Watson, in common with other palaeontologists, regards these embolomerous amphibians as being practically the stem group of all higher vertebrates. In the arrangement of the surface bones of the skull these early gill-bearing forms (Fig. 1, II) go far toward bridging the gap between fishes and amphibians. In fact they have inherited all the fundamentally piscine arrangement of the bones of the dermocranium described above, so that one may easily recognize most of the roofing bones, the maxillary series, the circumorbital series and the temporomandibular series. Only the opercular series of the fish skull has disappeared, probably in connection with the change in habits. There is nothing unusual about bones dwindling away and disappearing as we pass from older to later types. The late Professor Williston of the University of Chicago brought forward much evidence showing that this reduction in number of elements, together with further differentiation of the remaining elements, is the normal course of skull evolution in vertebrates. Hence the absence in the oldest amphibians of the whole series of opercular and gular plates is no bar to the derivation of the amphibians from fishes. The place where the chief opercular bone formerly was is occupied in the earliest amphibians by a large notch, commonly called the otic notch. The skin covering this region was already beginning to function as a tympanum or eardrum.

REPTILES

The third stage is represented by a very primitive land-living form (*Seymouria*) from the Permo-Carboniferous beds of Texas (Fig. 1, III). This is technically classed as a reptile but retains many pronounced amphibian characteristics throughout the skeleton. In this highly important form as studied by Cope, Broili, Williston, Watson and others, the otic notch is still

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FIG. 1. TEN STRUCTURAL STAGES FROM FISH TO MAN. THE SKULL IN NORMA LATERALIS

I. Rhipidistian fish, Devonian (essentially *Rhizodopsis*). After Traquair, Watson.
II. Embolomerous amphibian *(Eogyrinus)*, Lower Carboniferous. After Watson.
III. Primitive cotylosaurian reptile *(Scymouria)*, Permo-Carboniferous. After Broili, Williston, Watson.
IV. Primitive theromorph reptile *(Mycterosaurus)*, Permo-Carboniferous. After Williston.
V. Primtive gorgonopsian reptile *(Scymnognathus)*, Permian. After Broom.
VI. Primitive cynodont reptile *(Ictidopsis)*, Triassic.
VII. Primitive marsupial *(Eodelphis)*, Upper Cretaceous. After Matthew.
VIII. Primitive primate *(Notharctus)*, Eocene.
IX. Anthropoid (Chimpanzee).
X. Man.

large and the intertemporal and supratemporal bones are still retained. The maxilla, as in fishes, does not extend upward on the side of the face, while the lacrymal is elongate and reaches from the orbit to the anterior nares.

The fourth stage is represented by one of the more primitive of the theromorph reptiles of the Permian of Texas (Fig. 1, IV). Here the maxilla is beginning to grow upward, while the lacrymal has lost its extension to the nares. In the temporal region of the preceding stages the jaw muscles had been covered with an outer shell of bone, but in this form the shell had been perforated by a process of natural trephining in such a way that the middle of the area of origin had become thin and finally was perforated by the jaw muscle, while the outer margin of the area had become strengthened and built up into curved bars or arches. This opening and these bars are of profound morphologic importance, since they mark the very beginning of the temporal fossa and zygomatic arch of man.

The fifth stage is furnished by one of the mammal-like reptiles from the Permian of South Africa (Fig. 1, V), as described by Broom, Watson and other authors. Here the maxilla has already become the dominant element of the face. With the enlargement of the temporal fossa the surrounding bars of bone stand in clearer relief and we recognize easily the beginning of the mammalian zygomatic arch. In the lower jaw, the dentary sends upward and backward a strong process which overlaps the surangle. This process will be of critical importance in the further evolution of the skull.

The sixth stage is one of the smaller cynodonts from the Triassic of South Africa (Fig. 1, VI). Technically these forms are classed as reptiles, but their whole skeleton shows a most interesting mixture of inherited reptilian and prophetic mammalian characters. In the skull the maxillary is the dominant facial element and the temporal fossa is almost wholly mammalian in type. The postfrontal bone has disappeared but the prefrontal, postorbital, jugal and lacrymal remain. In the lower jaw the dentary is now dominant and its ascending ramus is now reaching upward and backward toward the squamosal bone. The jaw elements behind the dentary, namely, the surangular, angular and articular, together with the quadrate bone of the upper jaw, are much reduced in size in comparison with those of the earlier members of the series. The dentition also is almost mammalian, being now thoroughly differentiated into incisors, canines, premolars and cuspidate molars.

MAMMALS

The most progressive cynodonts of the Triassic in many characters approach the more primitive carnivorous marsupials of the present time, especially in skull structure. But between them and the well-known placental mammals of the beginning of the Eocene epoch lies a vast gap of at least several million years in duration. During the long ages in which the dinosaurs flourished the mammals remained small and inconspicuous and left as fossils tantalizingly few teeth and jaws, and hardly any skulls. A few years ago Mr. Barnum Brown of the American Museum of Natural History found embedded under the skull of one of the great dinosaurs of the Upper Cretaceous the fossil skull and jaw of a small mammal (Fig. 1, VII) which has

proved to be closely related to the existing opossum. Solely upon anatomic evidence it has long been recognized that the opossum is one of the most conservative types of mammalian living fossils now extant, and that in fact it has preserved most of the essential characters of a pre-placental Mesozoic mammal. Hence it is significant to observe that in the lateral aspect of the skull the Cretaceous and modern opossums retain a strong fundamental resemblance to the most progressive of the mammal-like reptiles.

In this seventh stage, however, the basal mammalian characteristics are well established. The most important fact is that the ascending ramus of the lower jaw has grown backward and upward until it has gained contact with the squamous portion of the temporal bone where it has formed a new joint, the temporomandibular articulation common to all mammals, but not yet achieved by any reptiles, with the doubtful exception of some of the diademodont division of the cynodonts. Meanwhile the lower jaw elements behind the dentary, namely, the surangular, angular and articular, have disappeared, at least from the lateral aspect of the skull. To anyone who may doubt the validity of these inferences we may recommend the thorough study of the numerous papers of the late Professor E. Gaupp of Fribourg, one of the greatest morphologists of our time.

In passing from the reptilian to the primitive mammalian stage one sees clear examples of Williston's law of the progressive reduction of the skull elements. The supratemporal and intertemporal had long since disappeared. The cynodonts went further and dropped the postfrontal. The mammals went still further and cast off the prefrontal and the postorbital, leaving only the lacrymal and the jugal of the original five circumorbital bones.

But from the oldest mammals to man there will be no further reduction in the number of skull elements.

Light on the condition of the skull of the placental mammals during Cretaceous times has recently been gained from the highly important discovery by the Third Asiatic Expedition of the American Museum of six skulls and parts of skulls of Cretaceous mammals, which have recently been described by the author, in collaboration with Dr. G. G. Simpson of Yale University. These skulls lend much weight to the view of Huxley, Osborn, Weber and others that all the placental mammals of Eocene and later ages started from small insectivorous mammals. In spite of their far-reaching significance, I have not placed a figure of any of these skulls in the series showing ten structural stages for the reason that the exact arrangement of the sutural boundaries of the skull bones are for the most part not very clear. But in the form of the upper and lower premolars these Mongolian Cretaceous placentals afford an invaluable and long-sought-for stage in the evolution of the cheek teeth of the higher mammals, as I have shown in the December number of the American Journal of Physical Anthropology.

PRIMATES

Passing then to the eighth stage of the series, we come to the primitive Primates of the Eocene of North America, here represented by the genus *Notharctus* (Fig. 1, VIII), excellent skulls of which are in my custody at the

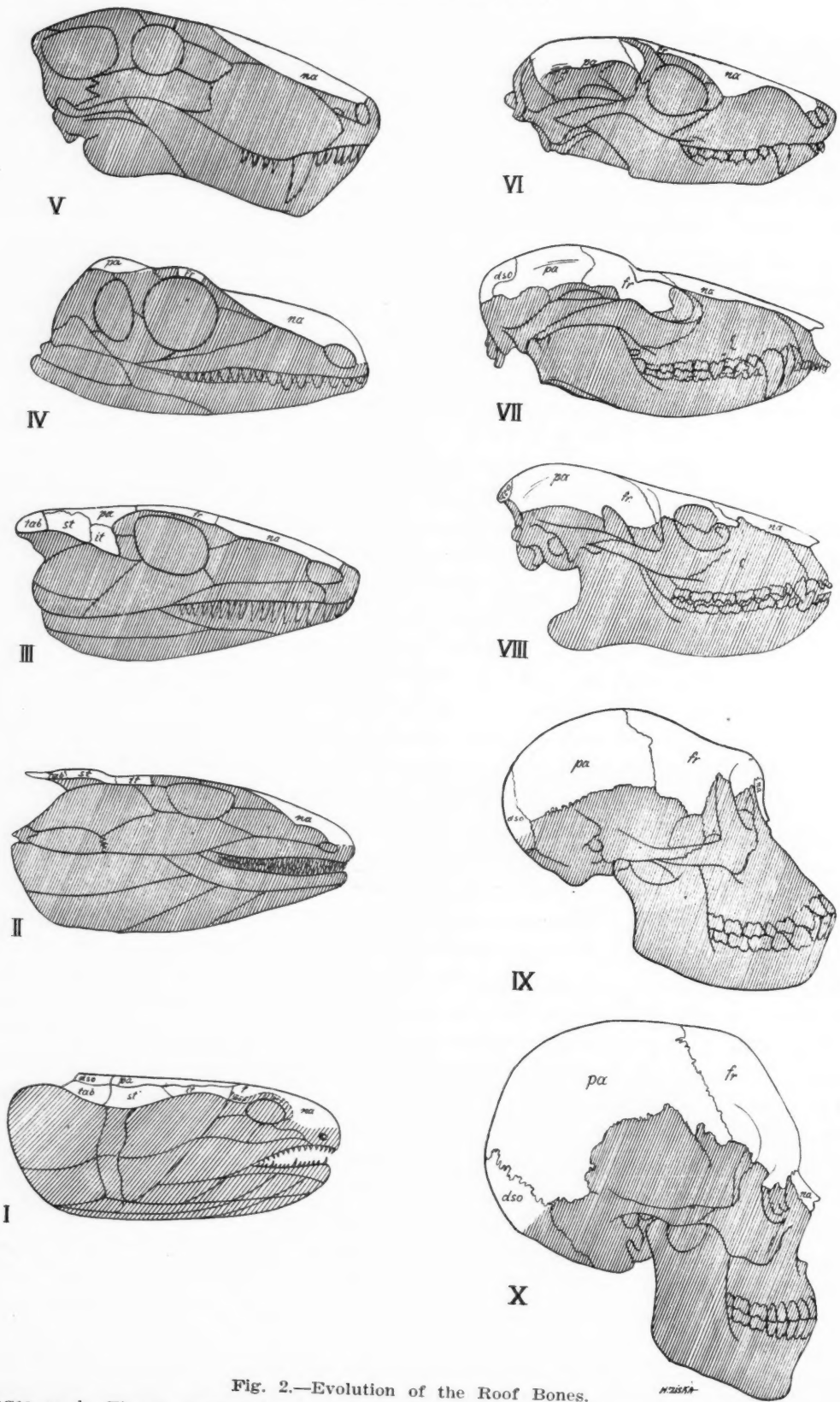

Fig. 2.—Evolution of the Roof Bones.

Stages as in Fig. I, except VII, in which the modern instead of the Cretaceous opossum is used.

American Museum of Natural History. In the earlier mammals, as noted above, the postorbital bone had already disappeared, so that the temporal fossa was broadly continuous with the orbits. But the Primates, like certain other lines of mammals, notably the ruminant artiodactyls, soon found it advantageous to protect the eye by a postorbital bar and at the same time to brace the origin of the masseter muscle. Accordingly the frontal bone, which in the earlier vertebrates had been shut off from the orbits by the pre- and postfrontals, after the disappearance of these elements became the dominant element of the orbit and now sent downward a strong process, the postorbital process of the frontal, which met a similar process uprising from the jugal or malar bone. The eyes in the primitive stage are directed outward and forward. Meanwhile the angular process on the dentary or inferior maxillary had become prominent in correlation with the increasing obliquity of the pterygoid and masseter muscles. In the upper jaw the maxilla now effected contact with the frontal. The dental formula of *Notharctus,* namely, $I\frac{2}{2}$ $C\frac{1}{1}$ $Pm\frac{4}{4}$ $M\frac{3}{3}$ is undoubtedly more primitive than that of any higher primates.

The ninth stage of the present series is represented by the chimpanzee (Fig. 1, IX), which is the least specialized in skull form of the existing great apes. From the detailed comparison of the jaws and teeth of the chimpanzee with those of the various species of fossil anthropoids referred to *Dryopithecus* and allied genera, I conclude that the skull form of female chimpanzees is not widely different from that of the inferred common ancestor of man and the higher anthropoids, and I find strong support for this view in many directions, especially in the masterly last work of that great anthropologist, Schwalbe.

Granting then, for the moment at least, the view that in many respects the skull of a female chimpanzee is less advanced along the path of evolution than that of man, how does it differ from that of the vastly older and truly primitive skull of the Eocene primate *Notharctus?*

In the first place the chimpanzee has advanced beyond its Eocene predecessor in the forward shifting of the orbits, which are now directed completely forward so as to effect binocular, stereoscopic vision. Next, the postorbital septum now completely separates the orbit from the temporal fossa in the lateral view. With the assumption of brachiating habits the braincase has rotated forward and downward upon the column and the face has bent downward upon the basicranial axis. The premaxilla has fused with the superior maxilla and the greatest diameter of the latter is now approaching the vertical plane. The maxilla sends forth two prongs on either side of the lacrymal, the former touching the frontal, the latter separating the lacrymal from the jugal. The dental formula has become reduced by the elimination of the first two premolars above and below, so that it is now the same as in man; the jaw is shortened and thickened, its angular process has also expanded and merges anteriorly with the mandible itself.

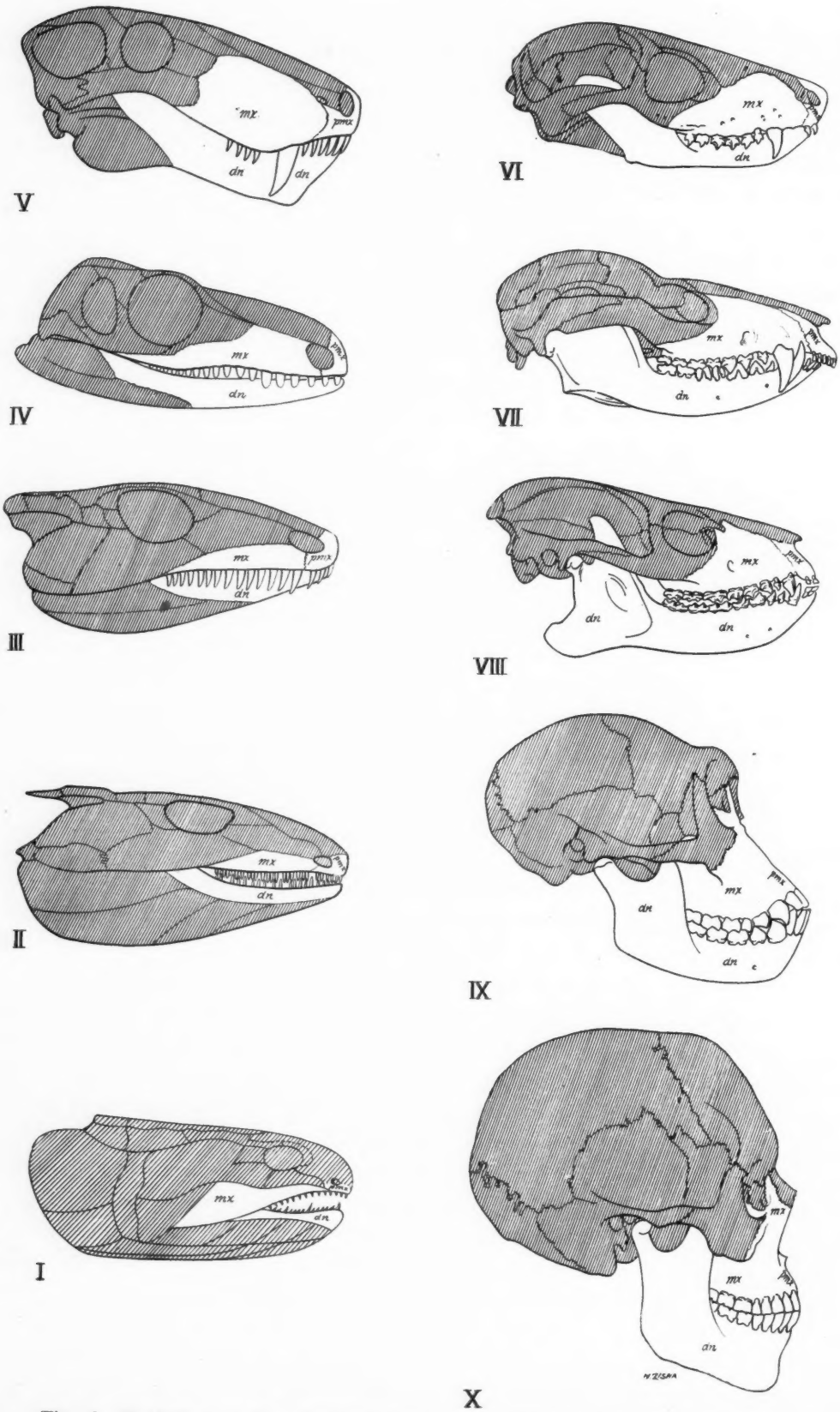

Fig. 3.—Evolution of the Maxillary Series (Premaxilla, Maxilla, Dentary).

MAN

Viewed in this perspective the human skull (Fig. 1, X) is seen to differ from that of the chimpanzee chiefly in the further development of the characters by which the chimpanzee differed from the earlier Primates. All the advances gained by the chimpanzee have in fact been carried much further in man. The greatest diameter of the face is now vertical rather than horizontal and the shortened jaws have been retracted beneath the forwardly-swelling and now enormous braincase. The dentition is enfeebled and a chin is present. But all these and many other differences are quantitative, not qualitative, and they measure the extent to which the human skull has out-distanced that of its humble relative, the chimpanzee.

CHANGES IN THE BONES OF THE SKULL

To recapitulate, the outstanding changes in the lateral view of the skull from fish to man appear to have been as follows:

Of the bones on the roof of the skull (Fig. 2), namely, the nasals, frontals, parietals, interparietals (or dermo-supraoccipitals) and tabulars, only the last disappear entirely in the mammals. As the brain enlarges these roofing bones are lifted into greater prominence, the frontals, parietals, interparietals and occipitals becoming the dominant elements in the great vault of the human skull.

The superior maxillary bone (Fig. 3) begins as a slender, vertically shallow element, but by the time of the early mammal-like reptiles (Fig. 3, V) it has extended dorsally and gained contact with the nasals. In the mammals (Fig. 3, VII-X) its dominance is still more pronounced; one fork reaches the frontals while another fork finally separates the lacrymal from the jugal and the whole bone becomes shortened antero-horizontally and deepened vertically. In the anthropoids and man the premaxillae early unite with the maxillae.

The inferior maxillary (dentary) at first is confined to the anterior half of the mandible. In the higher mammal-like reptiles it becomes dominant, the post-dentary elements retreating before it. In the earliest mammals the ascending ramus of the dentary effects a new contact with the squamosal, the temporomandibular articulation, which is transmitted without further essential modification to man.

Of the bones around the eye (Fig. 4), originally five in number, three (the prefrontal, postfrontal, postorbital) are eliminated by the time of the earliest mammals, so that man inherits only two of the original five, namely, the lacrymal and the jugal or malar.

The temporomandibular series (Fig. 5), originally including eight bones (the intertemporal, supratemporal, squamosal, quadrato-jugal, surangular, angular, postsplenial, splenial), suffers gradual reduction, until in the earliest mammals, as in man, only the squamosal remains, at least in the lateral view of the skull. In the mammals the squamosal has fused with the enlarged periotic mass and in the anthropoids and man the tympanic is added, the whole complex forming the temporal bone.

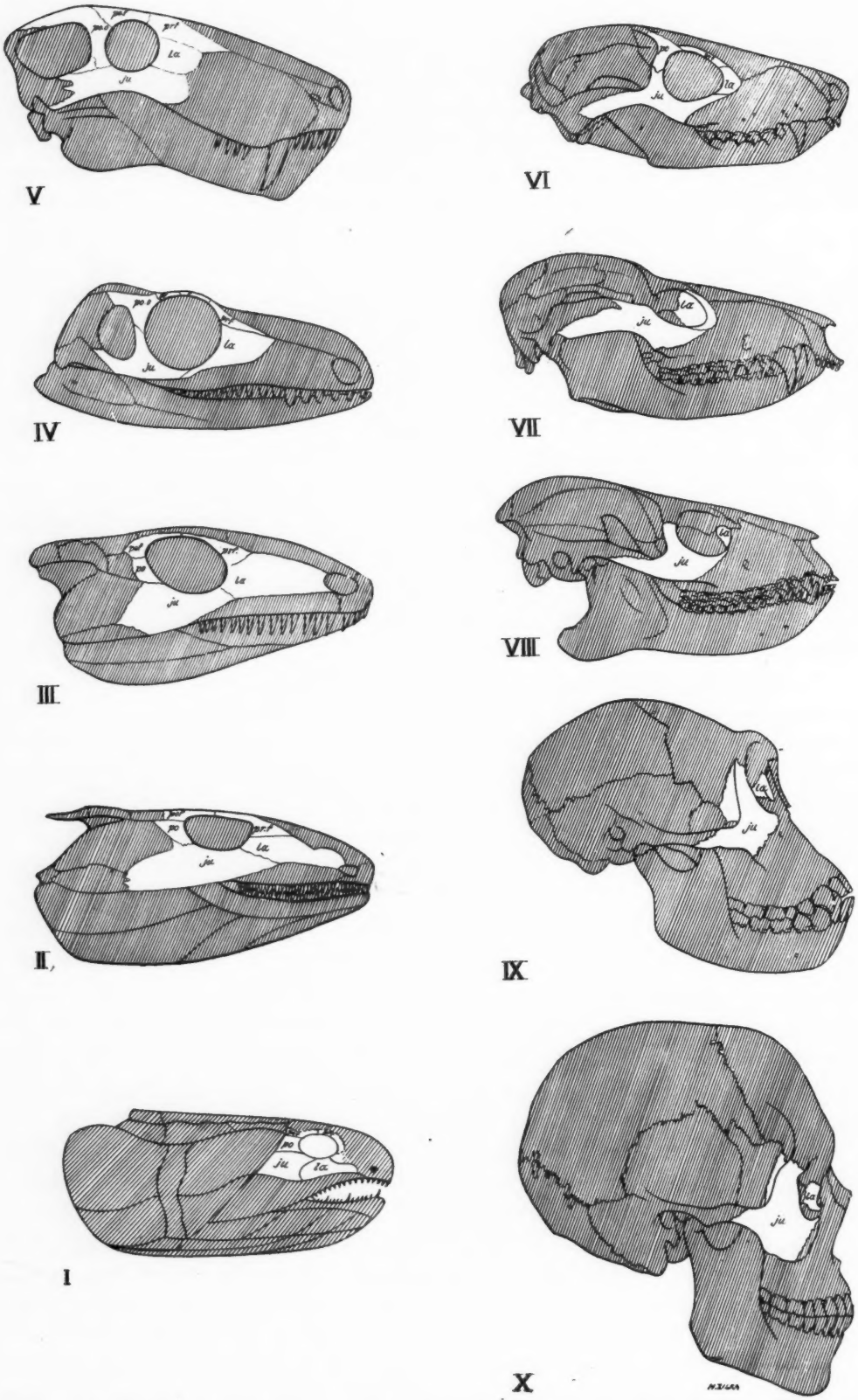

Fig. 4.—Evolution of the Circumorbital Series (Prefrontal, Lacrymal, Jugal, Postorbital, Postfrontal).

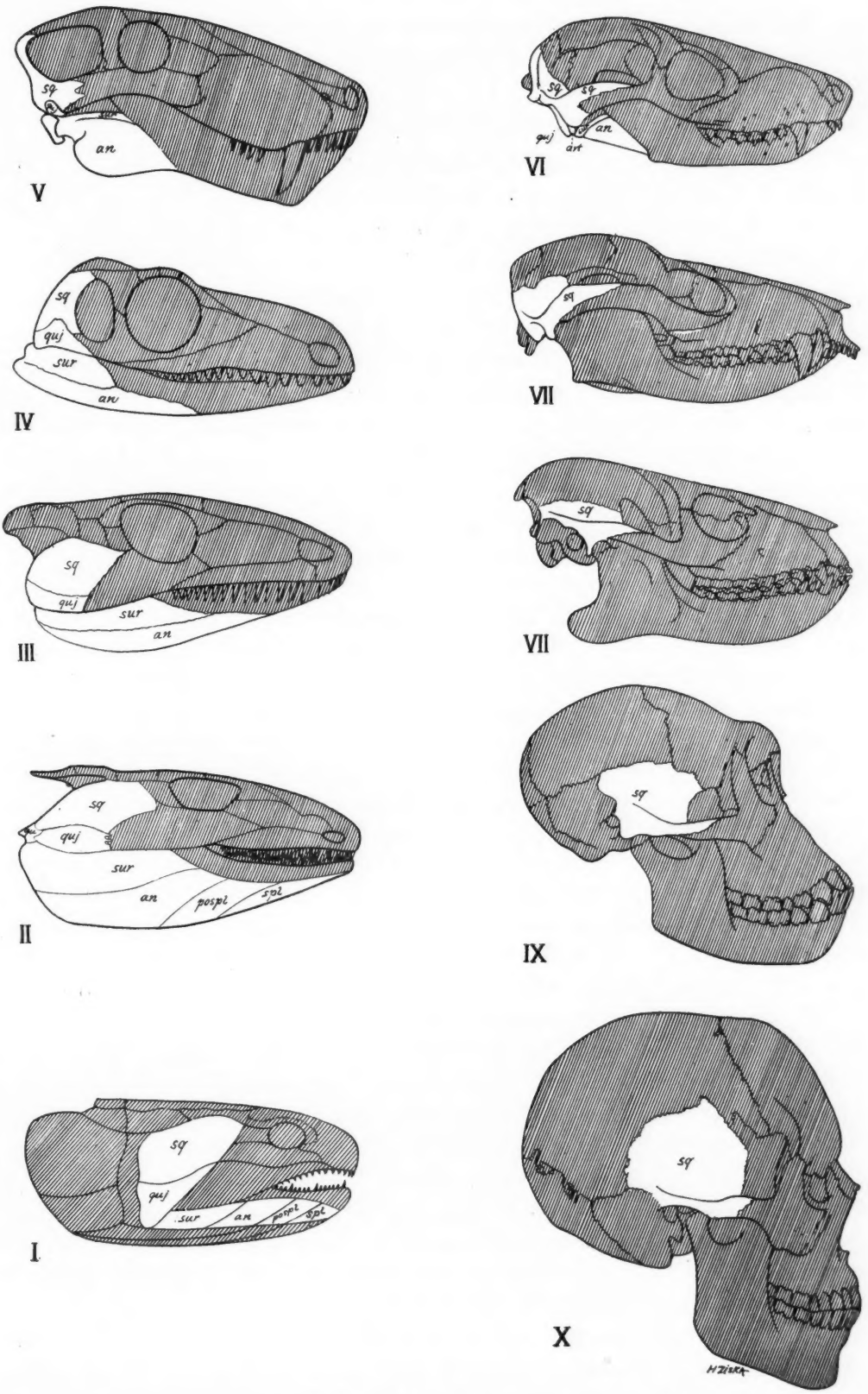

Fig. 5.—Evolution of the Temporomandibular Series (Squamosal, Quadrato-jugal, Surangular, Angular, Postsplenial, Splenial).

The changes in the endocranium and on the under side of the skull are no less plain and will be dealt with in other papers.

CORRELATION OF STRUCTURAL EVOLUTION AND CHANGES IN HABITS

At every successive stage of evolution advances in skull structure were dependent upon improvements in the brain itself, upon shiftings and enlargements of the parts containing the sense organs, upon modifications of the jaws and teeth, accompanying or accompanied by changes of habits. The skull in turn is closely integrated with both the active and the passive elements of the locomotor apparatus, a topic which will be developed elsewhere.

To each of the stages described above man owes certain "basic patents," or adaptive improvements which have been of critical importance in his survival. Thus to certain far-off Devonian air-breathing fishes man owes the general ground plan of the vertebrate skull, the combination of primary "gill-arch" jaws with sheathing or outer jaws, and each and every one of the twenty-eight normal skull bones which he still retains.

Next, he is indebted to the first amphibians for partially solving the innumerable problems caused by emergence from the water. These old pioneers cast off the whole series of bones that covered the branchial chamber and made for themselves an ear drum out of the skin around the notch where the opercular was formerly located. The early reptiles safeguarded most of the inheritance from their semiaquatic ancestors, dropping only the inter- and supratemporals. To the first of the mammal-like series man owes the beginnings of his temporal fossa and zygomatic arch, and the dominance of the superior maxilla. From the higher mammal-like reptiles he has inherited the further development of the temporal fossa and especially the dominance of the inferior maxillary or dentary bone of the lower jaw. To these progressive promammals man can render thanks for the differentiation of his dentition into incisors, canines, premolars and molars, and apparently he can also thank them for the reduction of the numerous successional teeth to two sets, corresponding to the milk teeth and the permanent set.

The earliest mammals invented one of the most useful features of man's skull by eliminating from the masticatory apparatus all the elements lying behind the dentary and by establishing the temporomandibular joint. They also cast off the reptilian prefrontal, post frontal and postorbital bones and cleared the way for the final simplification of the bony scaffolding of the face.

To the earliest primates, well schooled in arboreal life, man owes the first steps in the glorification of the eyes, which become increasingly dominant. These still lowly but thrifty forebears made good the loss of the reptilian postorbital bar by elaborating a new one from conjoining processes from the frontal and jugal (or malar) bones.

But still greater was our debt to the arboreal pro-anthropoids, those intelligent beings who elected to develop sight at the expense of smell. These skilled acrobats, moving in a vertical position, met and solved a new series of problems connected with the turning downward of the skull upon the up-

right column. They also made the first notable attempts to shorten and deepen the face and even took a long step toward enlarging the brain and brain chamber.

Starting with these and many like advantages gained during a long training in arboreal life, it was the task of our relatively nearer precursors (beginning possibly in Miocene times, or earlier) to re-adapt all these arboreal adaptations for a life on the ground and to take the final steps upward that have brought humanity to its present relatively high level of intelligence.

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THE FREQUENCY OF ORTHODONTIC ANOMALIES AT VARIOUS AGES

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Orthodontic Clinic of the University of Bonn

ALTHOUGH numerous dental examinations of school children have been made during the last ten or twenty years for caries, and will continue every year because of the systematical "Dental School Treatment," only very seldom has an attempt been made to study the deformities of the jaws, which play no less a part in the welfare and health of the child than does caries. If cases of irregularities of the teeth were considered, it was only to ascertain the degree or the extent which was responsible for or favored tooth decay. (Rose.)

If we ignore the occasional estimates of the frequency of anomalies and which are without any sound foundations, then the statistics of Angle are the only reliable statements in this respect. Angle divides, without going into details, the frequency into his three classes, giving the following figures in 1000 cases:

Class I	692
Class II	
Division 1	90
Subdivision	34
Division 2	42
Subdivision	100
Class III	
Division	34
Subdivision	8
	1000

Without disregarding the great merits of Angle, I must say that I cannot get a clear picture when I read: out of 1000 cases there are 692 in Class I. This class includes a great number of irregularities: contracted upper arch with anterior crowding, maxillary constriction with labial prominence of the canines, protrusion of the upper arch caused by thumb-sucking, open bite, and abnormal overbite with the external appearance of Class II, division 2, but with no posterior occlusion. In this group containing nearly 70 per cent of all existing anomalies, the most heterogeneous deformities of the jaws caused by different claims of genetic factors can be found. As to the frequency of these anomalies, we do not know anything.

To prove the frequency of anomalies with the deciduous teeth Chiavaro made in 1913 an examination of 1000 children of the ages from three to six

years, giving as the result of his research a frequency of 29 per cent. In details these anomalies could be classified, according to Angle's statistics, as follows:

Class I	222	anomalies
Class II	41	"
Class III	26	"

A similar examination on children of a juvenile age in the city of Leipzig was made in 1922 by Thielemann, a student of Pfaff, resulting in a considerably higher percentage. He found 49 per cent (48.7 per cent) of anomalies: 42 per cent neutral occlusion, 4.3 per cent distal occlusion and 2.4 per cent mesial occlusion.

Both authors considered a number of anomalies which should range under Class I, as for instance: the diastema (frenum labiorum), anterior crowding, incisival prognathie, etc. It is dangerous to compare the results of two examiners, as both while establishing anomalies had different views, one considering a case still normal, while the other one took it as an out-spoken anomaly. Also for another reason the results of Chiavaro and Thielemann must be differently judged. The children examined, of a separate age, were varied in number and surely a smaller percentage was found with children at the age of three than of six. The greatest number of cases can be placed in Class I of Angle, containing the most heterogeneous types, which can be placed into series of different anomalies, but a warning must be given, not to do this without rules and regulations. Single symptoms, such as: anterior crowding, buccal and labial bite, incisival prognathie, tilting of teeth, etc., must be considered as special anomalies and to book their frequence accordingly.

The investigations of Chiavaro and Thielemann are limited to the anomalies of the first dentition. They cannot therefore be compared with the statistics of Angle, as he considers only anomalies of the permanent teeth.

In spite of the aforementioned statistics gained by numerous examinations, many questions are still left unanswered. The statistics of Chiavaro elucidate anomalies of the first dentition and Angle's statements give us a classification of anomalies. The result of an examination of a large number of patients with regard to the frequency of anomalies, considering deciduous and permanent teeth, is still needed.

The object of my researches, based upon an examination of school children of Bonn in the past year, is to throw more light on this question and on the development of the various deformations.

At the regular dental school examinations, I have examined 1211 children and I have chosen eleven schools of the various parts of Bonn, allowing for the different social conditions. I contented myself with the examination of children at the ages of six (beginning school year), and fourteen (leaving school year). These two ages were chosen for special reasons. At the first age, the changing of teeth is announced by the appearance of the first permanent molars, showing at the same time the deciduous teeth in their full number, and representing all the influences which had been at work up to that

time. This year of life will therefore illustrate the greatest number of anomalies of the first dentition. The second age examined has the advantage that the changing of teeth had been completed and the existing anomalies reached a stage which can only be increased very little in later years, giving therefore the highest frequence-figure of anomalies of the permanent teeth. Of the 1211 children, 643 were six years old and 568 fourteen years old. The number of each sex was about equal. The investigation permitted a comparison of irregularities at the two aforementioned ages, allowing an opportunity to study the increase, the decrease, and the modification of the various anomalalies.

The question: "Can the frequence-figures found with children of six and fourteen years of age be compared?" is of some special interest. Certainly it does not concern the same material, but it can be taken for granted

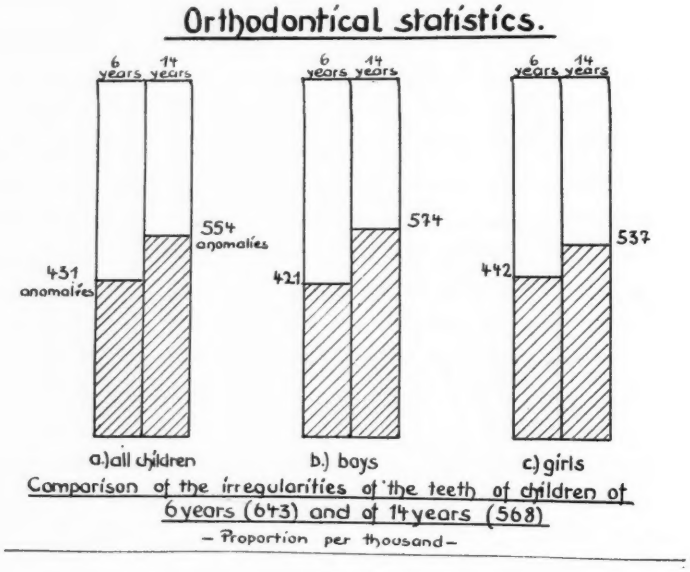

Fig. 1.

that, owing to the large number of observations, accidental results are practically excluded. The development of the children of fourteen years of age has, without doubt, been unfavorably influenced by virtue of the war famine. Also the children of six years of age have suffered a deficiency in feeding during the first years of their life, as this period covered the dreadful time of the German inflation. The different environment which influenced these two groups renders the comparison a little more difficult. Should this difference of world influence be considered, then one can assume a more unfavorable condition with the older children, thereby lowering the frequence-figures of anomalies found to a certain extent, if those children had experienced the same development as the six-year-old ones.

Fig. 1 shows clearly the frequence-figures of all abnormal cases in proportion to 1000. In column 1, where all children were considered, we find the following: 43 per cent of anomalies are found with children at the age of

six, and the percentage increases to 55 per cent with the children at the age of fourteen. Small and nonimportant differences exist between boys and girls.

I hope to have definitely demonstrated that even at the age of six an immense number of irregularities (431 out of 1000 cases) existed, the development of which lies in the period up to this age. This does not say, however, that the same number, i.e., four-fifths of the anomalies found at the age of fourteen, originates from the time up to six years of age. We have rather to assume that a certain part of deformities found with younger children, will be fully balanced by natural forces or have been transferred into another form of anomaly. I will come back to this fact at a later occasion, when discussing the various deformities.

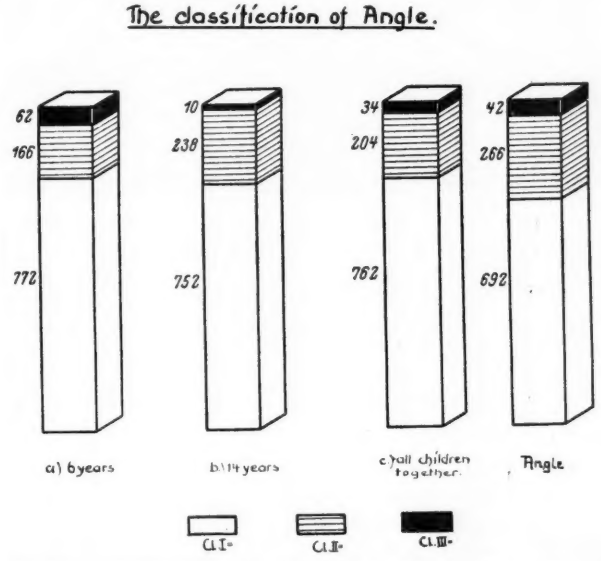

Fig. 2.—The result of the examination of all children according to the Classes of Angle.

With every child the exact kind of anomaly was established and this not only with regard to the mesiodistal relation, i.e., the classification of Angle, but all principal irregularities of the position of the teeth, characterising the anomaly, were distinctly and accurately noted. Accessory deviations from normal, the tilting of single teeth, light asymmetries, etc., and which had no greater cosmetic or functional disadvantages, were not taken into consideration. Many existing anomalies can be grouped showing in their genetic character and origin undoubtedly a certain relationship. A biologic-genetic classification based upon morphologic characteristics as introduced by Kantorowicz and Korkhaus the past year is naturally far from perfect owing to their incomplete knowledge of the origin of anomalies. A case showing protrusion of the upper teeth, the result of habitual thumb- or teat-sucking, is often combined with an "open bite" when the child bites more than sucks at its thumb; is of a secondary value for the tabulation of the deformation, if it shows Class I or Class II. The class gives only the degree of the anomaly, inasmuch as the more intensive and longer lasting sucking habit will be

followed by a distal occlusion. The importance of the mesiodistal relation of the molars from the point of treatment is in no way diminished by this fact.

Another group of deformities is caused by the special sucking activity of a bottle baby and in later years by functional disturbances in breathing as a result of adenoid vegetation. Here we find a contraction of the maxillary jaw and a crowding of the anterior teeth. The origin of this anomaly dates back the age of five to seven, when physiologic spaces between the deciduous incisors are developing. The widening of the anterior portion of the arch is arrested, resulting in a crowding of the erupting permanent incisors.

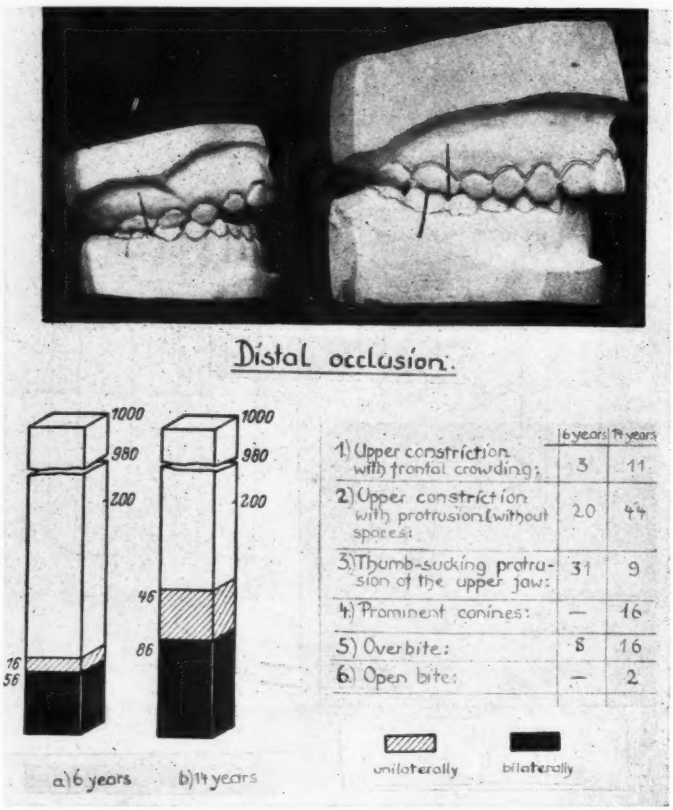

Fig. 3.

In the same group another anomaly may be included: the maxillary contraction with anterior protrusion. This protrusion is the result of the compression and is therefore narrowed, i.e., no spaces are existing between the protruded front teeth. In the mandible a small contraction of the side parts is also to be found; furthermore a retrusion and supraocclusion of the front teeth and in a number of cases (but not in all) a distal occlusion.

Coming to the vertical anomalies, caused by an overpressure on a bone weakened by rickets, a further group can be formed—the open bite. Also, we find a group as a result of the deficiency of the occlusion—the excessive overbite. Teeth not being in function have the tendency to lengthen and the characteristic sign of this bite is the linguoversion of the maxillary anterior teeth, fully overlapping the mandibular ones. The maxillary arch has its normal width and no difficulty in breathing is experienced. This deformation

has the cases belonging to Angle's Class II, division 2, but posterior occlusion is not always associated with it. My investigations will prove that the greatest percentage of this anomaly has a normal anteroposterior relation of the arches.

Last but not least, we must not forget the great group of abnormalities that arise as a result of premature loss of teeth, representing different external appearances and can be combined with all three classes of Angle.

A special consideration will be given to a series of typical anomalies, the genesis of which has not been incontestably cleared, such as: labial prominence of the canines, cross bite and edge-to-edge bite.

From this genetic point of view, the symptoms of the anomalies of each child were ascertained. The findings of this research shall now be presented

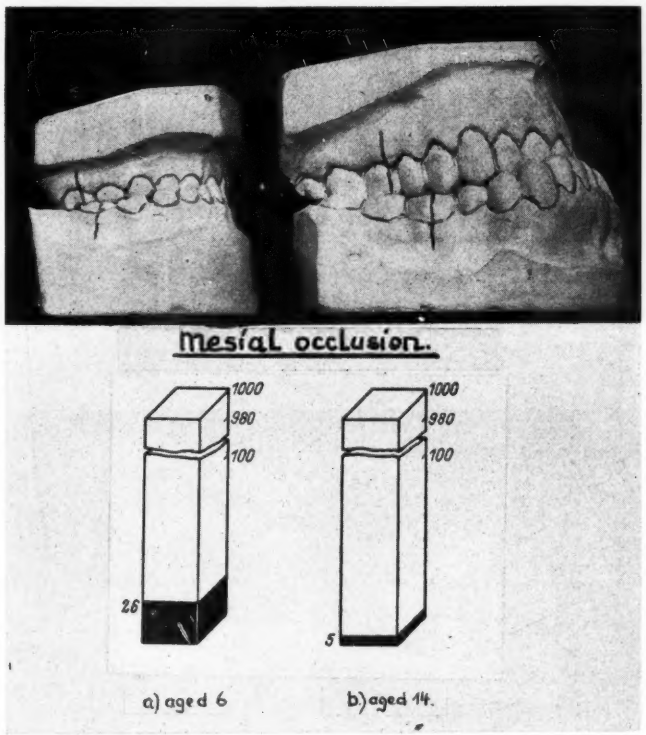

Fig. 4.

by a series of illustrations. As is often the case when a multiplicity of etiologic influences have been working to cause an anomaly, it is necessary to place one and the same anomaly in two or three different groups, as, for instance, a sucking-protrusion is often combined with an open bite or the compression of the upper jaw connected with a shortening of the arch as a consequence of a premature extraction. This accidental double counting makes the total of anomalies greater in number than the number of children affected, as already shown in Fig. 1.

The statistics of Angle have been frequently mentioned. In order to enable a comparison with Angle's figures, Fig. 2 shows the result of the examination according to the classification of Angle. From 1000 anomalies at the age of six, 772 had a normal anteroposterior relation, 166 had a posterior

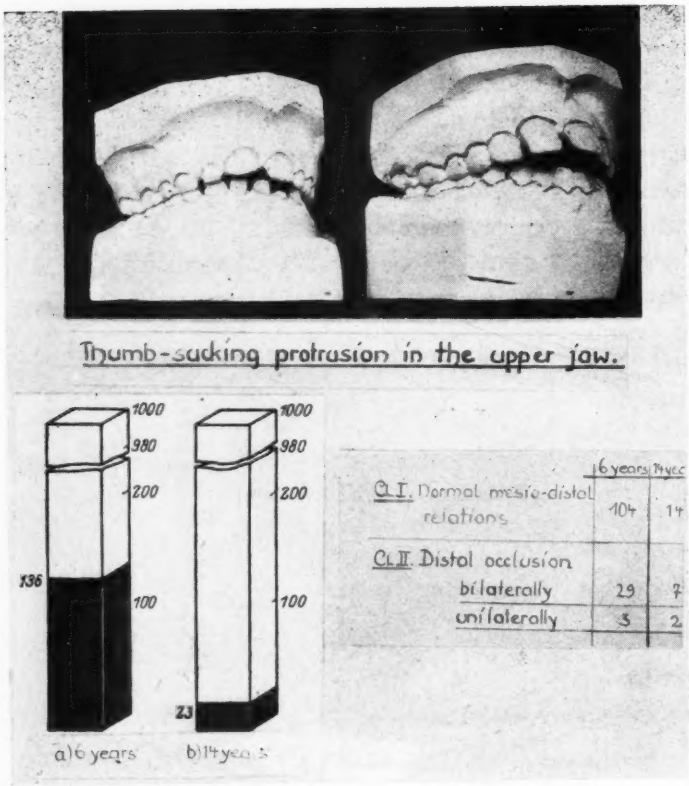
Thumb-sucking protrusion in the upper jaw.
1000
980
200
136
100
1000
980
200
23
100
a) 6 years
b) 14 years
6 years
Cl. I. Normal mesio-distal relations
104
Cl. II. Distal occlusion
bilaterally
29
7
unilaterally
3
2

Fig. 5.

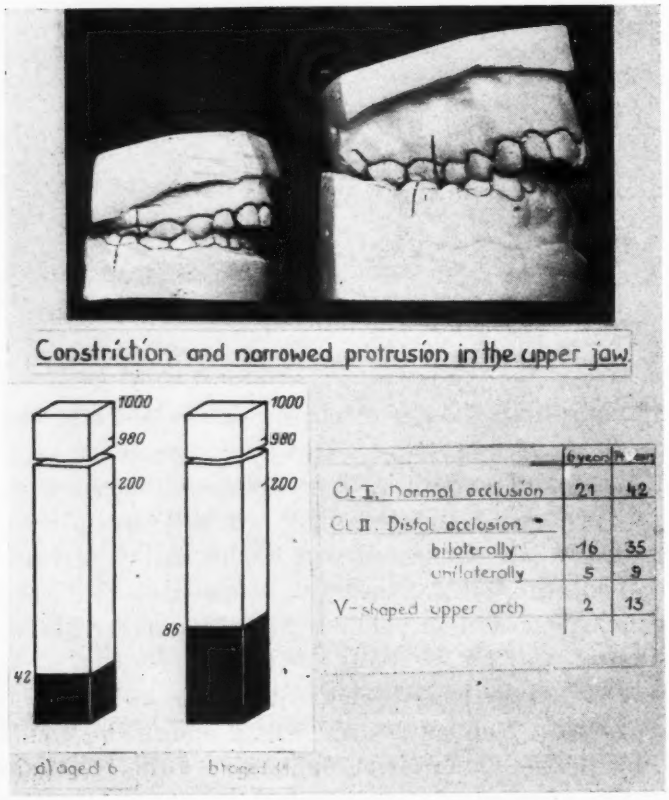
Constriction and narrowed protrusion in the upper jaw
1000
980
200
42
1000
980
200
86
a) aged 6
Cl. I. Normal occlusion
21
42
Cl. II. Distal occlusion
bilaterally
16
35
unilaterally
5
9
V-shaped upper arch
2
13

Fig. 6.

relation, and 62, an anterior relation. At the age of fourteen, 752 were of Class I, 258 of Class II, and 10 of Class III. The last two pillars of the illustration represent the confrontation of the figures of Angle with the figures found by me.

The comparison shows certain differences. I have found one-fifth of anomalies less than Angle, for Classes II and III. Angle has not published the age of the individuals examined by him; probably his investigations were performed on children at the ages of twelve to fourteen, who were coming for treatment. For this age my results show also greater numbers—at least

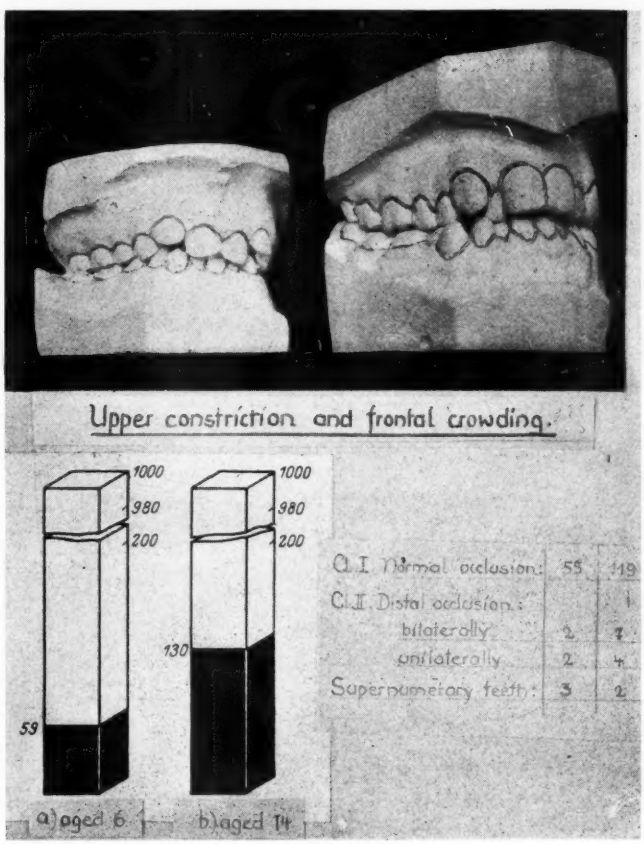

Fig. 7.

for Class II—but without reaching the frequence of Angle. The differences are, however, not so astonishing, if one considers that my investigations were based upon a quite different population; a quite different race with other modes of living and living under other climatic conditions.

Fig. 3 gives us a survey of posterior occlusion, finding already—in proportion to 1000—72 cases at the age of six, of which 56 were bilateral and 16 unilateral, whereas with children aged fourteen a great increase of posterior occlusion is to be seen, namely, 132 cases, of which 86 were bilateral and 46 unilateral. From the age of six to fourteen an increase of nearly double had taken place. The principal anomalies, showing posterior occlusion, are given in the six groups of this chart. By these statistics the anomalies

responsible for the increase of the distal bite can easily be recognized, namely, jaw compression and cases of overbites. On the other hand, a considerable decrease of the cases with sucking-protrusion can be noticed. As a complete self-correction of a typical posterior occlusion is not probable, the assumption that some of the sucking-protrusion have experienced a transformation may be correct. Probably under the influence of an all-around compression they have lost their characteristic spaces and are showing now an upper protrusion without spaces and are placed therefore under a different class.

Fig. 4 shows the figures of my examinations with regard to (Class III of Angle) anterior occlusion. Cases of anterior occlusion of the width of one premolar are very rare at a juvenile age. I have therefore taken all cases

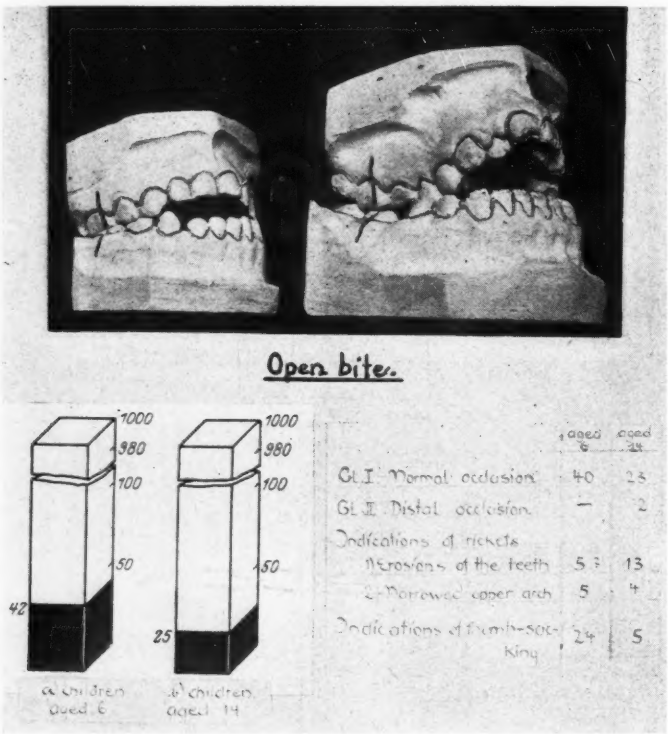

Fig. 8.

into consideration, showing a lower protrusion and a mesial dislocation of the mandible, even of only one-half millimeter. The comparison of the results found at the different ages proves a remarkable decrease. It seems reasonable to believe that a great number of cases with lower prognathium correct themselves by natural forces during the ages of six to fourteen. This is best confirmed by the observations of Kantorowicz who has found not infrequently a self-correction of anomalies and especially of cases with a beginning lower protrusion. The nature of correcting powers is still unknown and it must be left to further research to solve this problem.

Fig. 5 gives us a picture of sucking-protrusions. With the younger children, the consequences of thumb-sucking or teat-sucking were numerous: 136 cases of sucking protrusion and of this number 32 cases were posterior occlu-

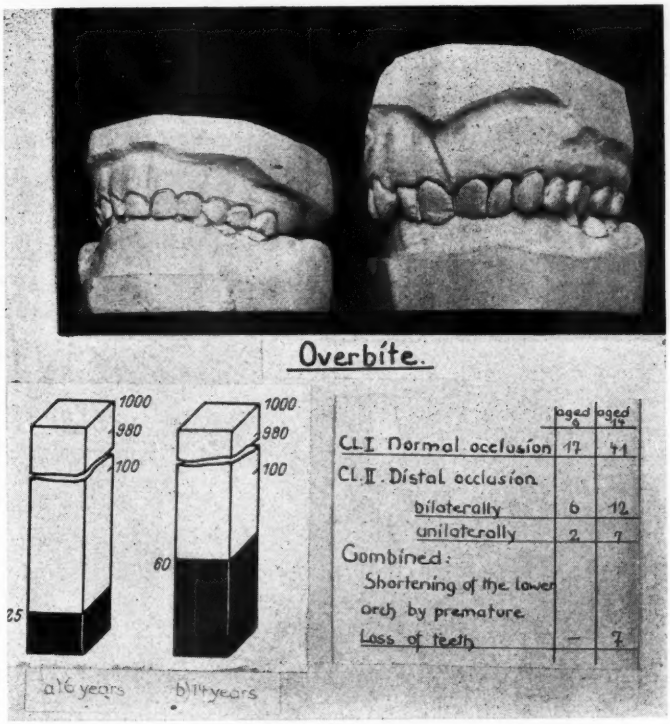
Overbite.
1000
980
100
25
1000
980
100
60
a) 6 years
b) 14 years
aged 6 aged 14
Cl. I Normal occlusion 17 41
Cl. II. Distal occlusion
bilaterally 6 12
unilaterally 2 7
Combined:
Shortening of the lower arch by premature
loss of teeth — 7

Fig. 9.

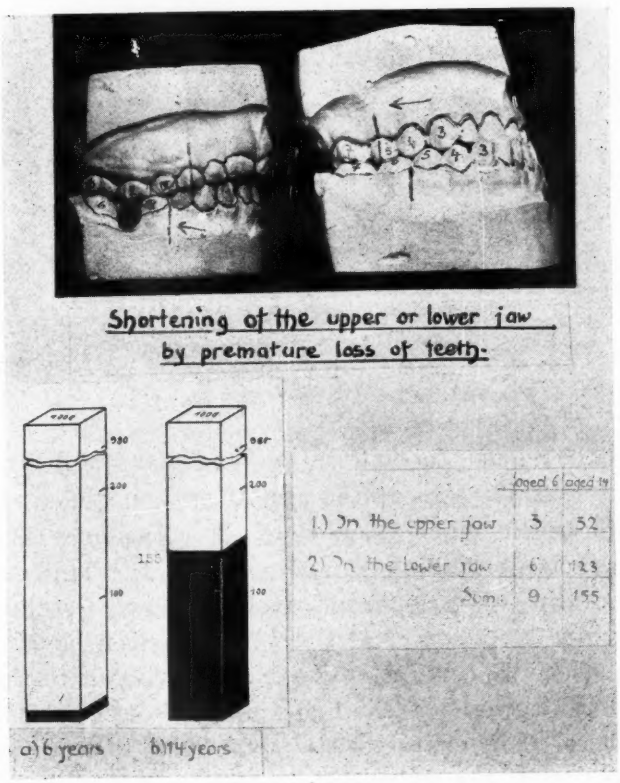
Shortening of the upper or lower jaw
by premature loss of teeth.
a) 6 years
b) 14 years
aged 6 aged 14
1) In the upper jaw 3 32
2) In the lower jaw 6 123
Sum: 9 155

Fig. 10.

sions. At the age of fourteen the number decreases to 23 and 9 cases. This large decrease can be explained by the fact that a great part of jaw deformations have adjusted themselves after discontinuing the habit of sucking with the eruption of the wider permanent incisors. Some have modified themselves with the change of teeth. Another part was, however, so strongly marked, or the sucking habit had continued, that the sucking-protrusion remained with the permanent teeth. If, while sucking, a pressure was exercised against the maxillary teeth by the thumb, an open bite was the consequence, as shown in some cases.

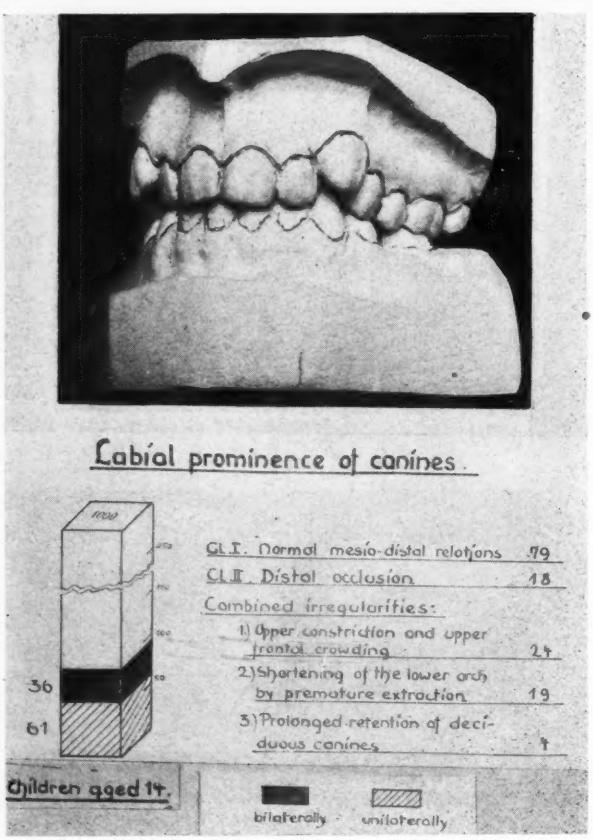

Fig. 11.

Fig. 6. With regard to contraction and narrowed protrusion of the upper jaw, we found 42 cases at the age of six, and 86 at fourteen, nearly doubling the number in eight years time. For this increase the disastrous effect of difficult nose-breathing is responsible. In details these anomalies are composed of 21 and 42 cases, respectively, of normal occlusion, and 21 and 44 cases of posterior occlusion; 2 at six, 13 at fourteen had the characteristic V-shaped upper arch. Special attention must be drawn to the fact that half of the cases are belonging to Class I and only the other half to Class II, although, by virtue of their characteristic symptoms (contraction of the maxillary arch, protrusion of the maxillary incisors, retrusion and supraclusion of the mandibular anterior part), they should all be classified with Class II,

division 1 (designated by Angle as mouth-breather). It is also apparent here that the cultivation of Class II is only a sign for a special intensive influence brought about by deforming forces.

Fig. 7 gives us the figures of cases of maxillary contraction and anterior crowding. Fifty-nine cases at the age of six are confronted, with 130 at the age of fourteen; i.e., an increase of more than double—a proof that the etiologic factors for this anomaly are still working after the age of six. As to the anteroposterior relations, 55 ages six and 119 ages fourteen had normal occlusion, while posterior occlusion was combined in four cases at six and eleven at fourteen. In 3 at six and 2 at fourteen we found an abundance of teeth had caused the anterior crowding.

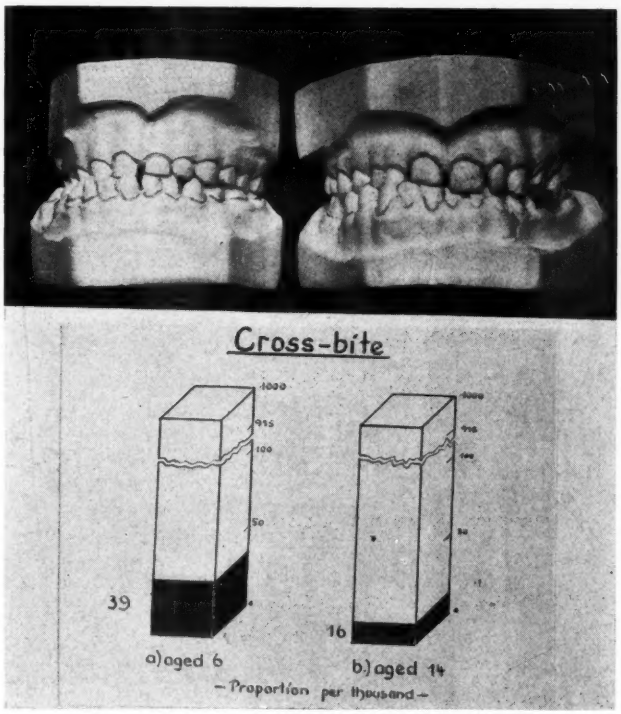

Fig. 12.

Fig. 8 deals with the frequency of the open bite. At the age of six 42 cases were established, while at fourteen the number of cases had diminished to 25. The frequent association of open bite with thumb-sucking (24 out of 40) with younger children on one hand, and the just as often found hypoplasias of the open bite with the permanent teeth on the other hand, proves that a different etiologic factor exists in the two groups. While the greatest percentages of open bites with children of six are the result of thumb-sucking, the cause for this deformation with other children is the lack of resistance of the jaw bones. The decrease in the frequence-figure of the open bite is the sign of self-correction by nature, due to the stoppage of the sucking habit. All cases of open bite with the exception of two of Class II had normal anteroposterior relation.

Cases of the excessive overbite illustrated here in Fig. 9 show a considerable increase during the time of changing teeth. These irregularities show the

following peculiarities: lengthening of the maxillary and mandibular incisors, lingual tilting of the maxillary incisors, which are, as well as the mandibular ones, in supraclusion and impinge upon the gums. Angle has classified them as a special division of Class II and in consideration of this fact my results are of great interest. Most of these anomalies have a normal anteroposterior occlusion and only one-third to one-fourth of the cases show a posterior occlusion. Premature extraction in the mandibular arch will in some instances be an etiologic factor. I found it in seven cases.

A very interesting thing is shown in Fig. 10. The deformities constitute a group of abnormalities which may be regarded as a result of premature loss of teeth. Children six years of age presented these abnormalities only nine

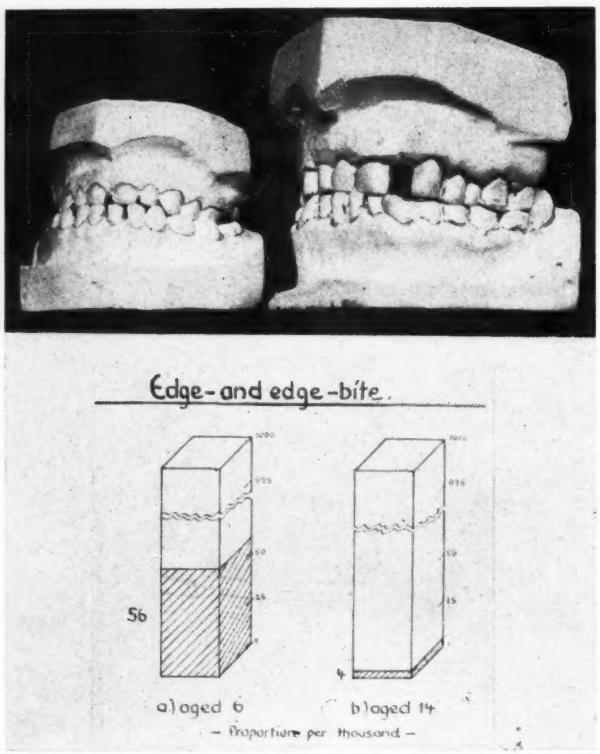

Fig. 13.

times, whereas older children showed 155 of such conditions. This number is especially remarkable as the systematic dental hygiene for school children has been introduced in Bonn, and consequently extractions of first molars at a juvenile age are very rare. Here I wish to state that the children of fourteen years of age examined by me were not subject to the systematic dental school treatment. These children were only treated in a police-clinical way. Only in the current year were all school classes included in the systematic dental hygiene of Bonn and it will be of special interest to ascertain how often consequences of tooth-extractions will be found with those children in the future. I will not omit to report the results in due time.

In nearly all cases premature loss of deciduous molars was the cause of the shortening of the jaw. It will be a fact that, in all towns where no sys-

tematic dental hygiene is in force, the number of these anomalies will probably show considerable increase. Most of the extractions had been made in the mandibular arch where the large number of 123 anomalies, at the age of fourteen, had been ascertained. As to the maxillary arch, the figures were smaller, hardly one-fourth of the number of anomalies found in the mandible. At any rate, the large increase, during the age under review, shows clearly to what extent the consequences of extractions are responsible for the development of anomalies and should therefore be a warning to all to avoid, if possible, all extractions during the time of development and especially the extractions of the deciduous teeth as the place holders in the arch.

The irregularity of labial prominence of the canines is illustrated in Fig. 11. In proportion to 1000 children, the frequency of this anomaly gives

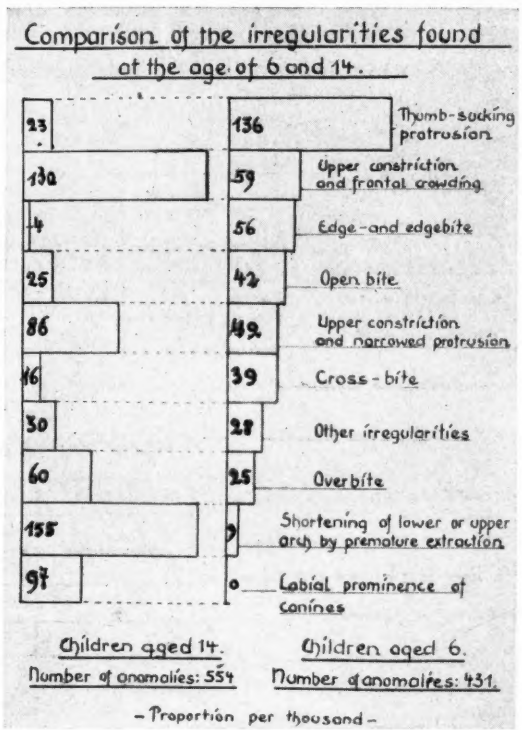

Fig. 14.

the following figures: 61 unilateral cases and 36 bilateral; 79 are combined with normal anteroposterior relation; 18 with posterior occlusion. Coupled with prominent canines, I found 24 cases of maxillary contraction and maxillary anterior crowding, and 19 cases in which a premature loss of teeth in the mandible had hindered the development of growth; mostly on the same side in which the maxillary canine was prominent. With four children a prolonged retention of the deciduous canines was the etiologic factor of the malposition of the canine.

Fig. 12 represents anomalies of a more moderate nature. The cross bite proves a more frequent anomaly with younger children. Unilateral thumb-sucking will be in most instances responsible for this anomaly, so that, after leaving off this habit, a self-correction may take place.

The edge-on-edge bite presented in Fig. 13 cannot be considered, in the proper sense of the word, a real anomaly. I found, however, the fact very interesting that, at the age of six, a great number are in existence, whereas within six years later they have practically disappeared. This bite, therefore, does not transfer itself to the permanent teeth. It can also be assumed that this occlusion does not exist with children of the age from two to three. In consequence this anomaly represents a modified form of occlusion which occurs in the time when the canines are ground down, so that the mandibular arch can advance. It is also, therefore, comprehensible why this bite is rarely found in children at the age of fourteen. In an advanced age this bite will be observed again, when the teeth, as a result of chewing, have been ground down to a large extent.

Figs. 14, 15, and 16 give a comparison of all anomalies found at the two ages of six and fourteen. In summing up the developments of the different groups of anomalies two sections can be easily established. The first group

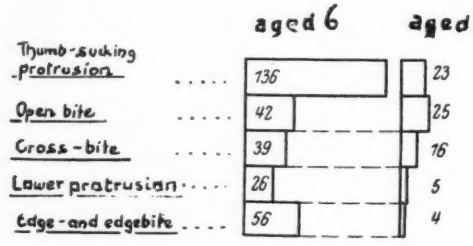

Fig. 15.—Anomalies which show an increasing frequency.

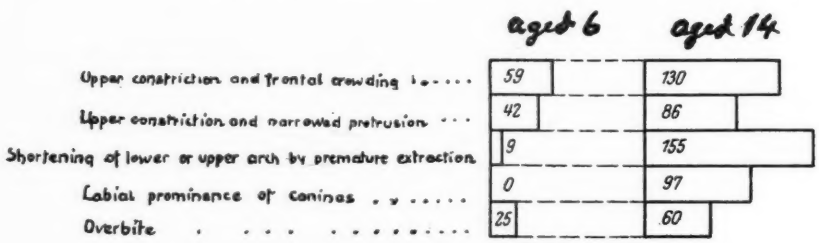

Fig. 16.—Anomalies showing an increase.

shows an increasing frequency during the ages from six to fourteen, while the second group has the tendency of a decrease during the same age. To the last-mentioned section all anomalies caused wholly or partially by habitual thumb-sucking are: thumb-sucking protrusion, open bite and cross bite. These anomalies have the tendency to correct themselves as soon as the sucking habit comes to a standstill, as long as normal mesiodistal relations are existing. An addition to this group of self-correction is the lower protrusion, which, also, to a great extent, adjust themselves as soon as the normal functions of the anterior teeth set in again, as proved by the observations of Kantorowicz; the cases of edge-on-edge bite have also decreased, being a passing form of occlusion changed by the eruption of the permanent incisors. To the first named section—showing an increase—we find all cases caused by disturbed breathing such as: maxillary contraction and anterior crowding; maxillary contraction and narrowed protrusion and the consequences of pre-

mature extraction of teeth. The only group showing a nonexistence at the age of six is the labial prominence of canines. Causes and reasons for this anomaly are also not yet established. This applies also to the overbite, which shows a considerable increase during the age under review. It can be assumed that the unknown causal factors originate at infancy, exercising their disastrous influence also during the school age.

If we compare the development of the jaws with the running pictures of a film, then the two examined ages represent two pictures of a most prominent position cut out of the film and placed under strict observation. And just as well as the observation of a few pictures gathered from the most important scenes are qualified to give a striking idea of the beginning and the procedure of the play, just as important consequences can be drawn from my researches with regard to the origin and the development of the different anomalies. It shall be left to further examinations and researches to throw more light on this subject and to solve problems, so far not solved.

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CONCERNING THE EFFECTS OF ORTHODONTIC TREATMENT ON THE MAXILLARY AND MANDIBULAR BASES

BY AXEL F. LUNDSTROM, STOCKHOLM, SWEDEN

IN A RECENT article,[1] Dr. Harry E. Kelsey, of Baltimore, has published some interesting cases of ankylosis, in which he claims to have effected considerable changes in the mandible through his orthodontic treatment. As he has had the kindness to refer to an article of mine, and as it is his opinion that the results he reports prove that my conclusions are wrong, I may be excused if I take up the matter to renew discussion. It is also my intention to say some words on account of what was mentioned by the gentlemen partaking in the discussion that followed the reading of Dr. Kelsey's paper.

Dr. Kelsey admits certain facts I have mentioned. He admits that the maxillary and mandibular bases do not always "respond" to the orthodontic treatment: "some are sluggish, others respond readily," and "after full maturity little if anything can be expected in the development of the maxillary bone or apical base, by any method the orthodontist has at his disposal."

We both agree in this: in some cases the orthodontic treatment is, and in others it is not, followed by a condition in the apical base that ensures a permanent result. We disagree in this: Dr. Kelsey attributes the difference in results to a different degree of reactibility of the basal region to the new

position of the teeth, whereas in my opinion the growth of the basal region is independent of the positions we are able to place the teeth in. Perhaps I am not wrong in assuming that Dr. Kelsey considers the difference as histologic and that in my opinion it is anatomic.

The reason certain cases do not "respond," or, to use another expression, the growth of the apical base does not keep pace with or attain a size corresponding to the corrected dental arch, is, according to Dr. Kelsey, a result of what might be called an osteoblastic sluggishness of various intensity. This sluggishness may after full maturity become so decided that "little if anything can be expected in the development, etc." Reduced to fundamentals this would mean that bone reacts to strains in a different degree in different individuals, and in certain cases after full maturity it does not react at all, at least as regards the permanent retention in corrected cases.

If it is to be expressed in physiologic or pathologic terms, what would we call this hypothetic "sluggishness" Dr. Kelsey speaks about? Unless we assume it to be some peculiarity, hitherto unknown or undescribed by biologic scientists, we ought to be able to find accounts of the phenomenon in question in our literature; I have not been able to discover anything which coincides with this sluggishness. In a textbook on oral pathology,[2] in Europe considered as one of the best and most complete treatises on the subject, the pathologic conditions of the jawbones are stated as belonging under three headings:

1. Degenerative changes.
2. Inflammatory changes.
3. Tumors of the jaws and dental tissues.

Apparently the sluggishness, if indeed possible to detect, cannot belong to the two last-mentioned groups. Under "degenerative changes" the authors mention two "disturbed metabolism" (comprising rickets and osteomalacia) and "primary arrestment of growth," to which belong "osteogenesis imperfecta" and "chondrodystrophia fetalis." But not even among these is it possible to range the phenomenon in question.

Let us assume that we have at our disposal an individual with "normal" jaws and a denture nicely developing along "normal occlusion" lines, with every indication of a final "facial harmony," as, for example, seems to have been the case of those Indians, whose pictures have been published in Dr. Angle's textbooks. We will assume that at a reasonably early age the attempt was made to expand the arches of one of these individuals, say, six millimeters, an amount not uncommon in orthodontic practice, and have each lateral half in ideal occlusion, the space that must occur being between the central incisors in both jaws.

Although we would in this case have no pathologic change in the bone, would we really expect the basal regions to have become remodeled to such an extent that the new position of the teeth would be permanent? Would we not be rather astonished if a relapse to something more or less approximating the "normal" width of the arches did *not* occur? And would it be correct to attribute such a relapse to "sluggishness"? Certainly, in an individual

like this, we would expect bone tissue to react with normal rapidity and to a normal extent.

We have ample evidence that bone *does* react to strains not only during the growth period, but also after maturity and even in old age. No sluggishness to respond can prevent the spinal bend that in advanced age results from change in the direction of stress nor the ultimate alteration in the form of the mandible following the loss of the natural denture. Dr. Kelsey's assumption of an occasional osteoblastic inactivity, for that is what his theory amounts to, is contradicted by facts.

Nor does Dr. Hugh MacMillan in the discussion following the reading of Dr. Kelsey's paper give any support to the theory that in certain instances the osteoblasts will not react in the way we wish. On the contrary, he accentuates very definitely that "Recent studies have shown the cardinal characteristics of its (viz., the alveolar process) compact and cancellous bone to be indistinguishable from that of a similar bone elsewhere in the body. The distribution of its compact and cancellous tissue is in direct relation to the mathematical structural requirements of the stress and strain, etc." He has quite a lot to say about the increase in the width of the nasal cavity, etc., but omits mentioning the hypothetic osteoblastic sluggishness and occasionally inability to the pressure strains.

No proof being given of any specific cellular inability to react against pressure and other stresses as the cause of relapse of cases, we must find some other explanation. And we have quite a number of facts which indicate that the basal portions of the jaws may attain a normal size in an anteroposterior and lateral direction although the pressure expended on them during mastication has been subnormal.

If this pressure is so necessary, how are we to explain the condition of the basal portions of the jaws in cases of individuals that have never had any teeth? Dr. Federspiel has related a case[3] in which the jaws had developed to normal size in spite of the congenital absence of a number of teeth. And Dr. Max Apfelthaler[4] has described a case of an individual born without teeth, and still the jaws were of a normal size. In this latter case the amount of pressure during "mastication" expended on the region where the teeth and alveolar processes ought to have been must have been much less than in cases of malocclusion. Are these cases of missing teeth mere freaks, of no interest in this connection?

Even one of the ankylosis cases reported by Dr. Kelsey[5] supplies evidence regarding the possibility of the maxillary base growing without the stimulation of mastication. For although this stimulation must have been reduced to a minimum, we still find the palatal arch fairly approximating normal width. If function, stress and strain from the occluding teeth are such important factors in the development of the maxillae, how are we to explain the fact that the basal portion of these bones is so near and perhaps up to the normal size in a case, in which the mandible was practically out of function for so many years? If, as Dr. MacMillan[6] states, "stimulation of the growing jaw is obtained *only* by mastication" how could in this case the maxillae grow at all?

Dr. MacMillan has in various articles published pictures of sections through the jaws, and has given good descriptions of what he considers the results of bending and pressure strains, etc. In one article he is evidently very unhappy because "men occupying high positions" will not understand "that bone is a plastic substance, adapting itself to its environment."[7]

If we admit that in all his specimens there is, and must be, a definite relation between the position of the teeth, the alveolar process, and the rest of the maxillary and mandibular bones, we must also admit that a definite relation is present in conditions of malocclusion. Also in cases of malocclusion a certain equilibrium is established. If we change the position of the teeth the stress and strain of the alveolar process will certainly cause a rearrangement. But to expect this rearranged bone structure to remain in its new position in every case after the retainers are removed is to *deny* the property of bone to adapt itself to new conditions; because in certain cases the removal of the retainers in reality does mean a new environment, or, more correctly, an environment more similar to the original condition.

The question at issue is not whether bone reacts to stresses or not, but if the changed occlusion really has brought the teeth into a state of equilibrium.

Before examining Dr. Kelsey's case and his claims to have changed the basal portion of the mandible, it may be of interest to study some earlier attempts to accomplish similar results in cases which more resemble our orthodontic patients than individuals who have not been able to move the mandible for a number of years.

The late Dr. C. S. Case has described a method for lengthening the mandible.[8] In cases of what he called "retrusion of the lower denture" he attempted to move forward "bodily" six or eight anterior teeth the required distance and closed the spaces with artificial substitutes. The very complicated apparatus he employed is shown in his book, page 252, Fig. 175. But is it really possible to accomplish what he attempted and evidently believed he had succeeded in doing?

Dr. George W. Grieve[9] says it is not. "If * * * a bodily-moving appliance is used, in conjunction with elastics, the roots of the mandibular incisors may be carried forward beyond the body of the bone, and where this is done there is danger of breaking down the labial plate of bone overlying these teeth and a certain amount of recession of the soft tissues is the result." This is a most definite assertion that the basal portion will not enlarge as a result of tooth movement, and yet Dr. Kelsey appears to consider the results of Dr. Grieve as evidence of the capacity of the occluding teeth to direct the final formation of the apical bases.

A careful study of Dr. Grieve's last article on the subject will clearly show that his method aims at "jumping the bite," with "little if any mesiodistal movement of the teeth in the bone."* Dr. Grieve also writes that he is convinced "that the more fully the forward growth * * * of the mandible is obtained, before the removal of the appliances, the greater will be the

*Dr. Grieve was formerly of a different opinion. In the INTERNATIONAL JOURNAL OF ORTHODONTIA, 1922, p. 434, he made the following statement: "it was necessary to carry all the teeth in the mandible bodily forward in the bone by means of intermaxillary elastics."

success in the use of this method." As the teeth do not move "in the bone," and as the mandible "becomes longer from the condyle to the symphysis," it is evidently Dr. Grieve's belief that the peculiar strain to which the mandible is submitted during his treatment will induce the forward growth.

To say this can be done is easy, to prove it is a very different matter. Two sources of error are present. One is the mobility of the mandible, through which it is possible to hold the mandible in an anterior position, giving the appearance of a larger mandible. And as regards the lengthening of the mandible from the condyle to the symphysis we must remember that a growth of this character is going on until the eruption of the third molars has taken place. Before we know what the normal increase is in this region in an individual of this age we cannot definitely ascribe the change to the treatment.

Unless mandibles in ankylosis cases respond in a very different degree to orthodontic stresses than our usual orthodontic cases, it would seem as if attempts to *develop* the bases with bodily-moving appliances on the anterior mandibular teeth would have results similar to those Dr. Grieve mentions; the roots of the incisors may be carried beyond the body of the bone, etc. But if they resemble them, concerning which I cannot give any opinion, then it seems to me that the magnificent improvements in the *occlusion* resulting from Dr. Kelsey's excellent treatment are chiefly to be attributed to a posterior movement of the maxillary teeth, a small anterior movement "in the bone" of the anterior mandibular teeth and to some extent a "jumping the bite." If really the increase in the distance between the bicuspid and the second molar in Dr. Kelsey's case, published in the June issue of the *Dental Cosmos,* 1923, (Figs. 2 and 12), is due to an actual lengthening of the base in that section, then Dr. Kelsey has succeeded in accomplishing by orthodontic means something that to the best of my knowledge has never been definitely proved as possible by any previous author, although it is evident that Dr. Case many times attempted it.

In the discussion following Dr. Kelsey's paper, Dr. B. W. Weinberger exhibited slides of a skull showing defective development of the maxillae combined with distoclusion. He made this statement: "* * * We can now see how clearly the maxillae and remainder of the face have been arrested in development in this case as a result of the improper relationship of the dental arches and the resultant improper functioning * * *."

Now we must admit that arrested development of the incisal region of the upper jaw is by no means always accompanied by distoclusion, being often found in combination with neutro- and anteroclusion. A condition very similar has been observed in certain domesticated animals and is hereditary. Whatever may be the functional result of a peculiarity of this character it is decidedly not itself a result of any change of function, as anomalies of this nature, "mutations" or "idiovariations" as they are called, cannot be produced by means of changes in environment. When we find in man a peculiarity so similar to an idiovariation in animals we ought to consider the possibility of its being of the same nature before we ascribe it to a subnormal function.

I would also like to make a few remarks in consequence of Dr. MacMillan's discussion of the paper of Dr. Kelsey, as he has attributed to me the most sweeping statement that "the maxillary bone proper, exclusive of the alveolar process, is incapable of reacting to artificial stimulation." If Dr. MacMillan is of a scientific turn of mind he must know that it is most important to be accurate, and that it is a serious injustice to an author to ascribe to him a quotation he never has made. If Dr. MacMillan would take the trouble to study my article he will find ample evidence that I have never denied that bone reacts to stimuli. For the benefit of readers who may not have time to find out for themselves, I will take the liberty to quote a passage from my article (INTERNATIONAL JOURNAL OF ORTHODONTIA, 1925, p. 1038): "Functional adaptation, which has so clearly been proved to affect muscles and bones * * * should be presumed also to affect the development of the masticating apparatus, even though it must be apparent from what has been previously stated that its influence is not of a nature to alter the apical base. If there are two masticating apparatuses that are identically alike, the only dissimilarity between their conditions being that the function of one is intensive and the other's weak, there will appear traces of this different stress * * *." To accuse a writer on orthodontic subjects of denying the property of bone to react to stresses or of being ignorant of the mass of evidence that has been accumulated to prove this, is equivalent to branding him as an analphabet in physiology. To appear before a section at an important meeting of the American Dental Association and accuse an absent confreré of denying facts, which he has expressly admitted and even gone into some details to attempt to explain, is contrary to established custom among scientific gentlemen.

Members of a branch of the healing art, whose practitioners are very much absorbed by the mechanics of its therapeutic measures, are under great risk of falling into the error of overestimating the effects of the mechanical devices they make use of. In the absence of scientifically fixed data and clearly demonstrated results of properly conducted experiments, more or less phantastic ideas will arise as to what is possible to effect with mechanical manipulations. The great efficiency of modern orthodontic appliances, and still more, the possibility of applying them and working them with a minimum of annoyance to the patient, resulting in the patient being able to tolerate a considerable amount of treatment with practically no discomfort, will tempt the enthusiastic mechanically-minded operator to try to accomplish results which, at an earlier time in the history of our art, have been in vain attempted, not because the older appliances lacked efficiency or the older practitioners lacked skill and perseverance, but because the methods were founded on ideas contrary to biologic facts.

Until we have succeeded in definitely proving what the real results of our manipulations are, much energy will be expended in the periodical reintroduction of methods of treatment, which a past generation of operators has used and discarded without reporting that as to permanence they were unsuccessful.

A student of the history of dental art will no doubt discover a number of instances of this rhythmic recurrence of principles of treatment. And the peculiar relation of the dental organs to the human organism as a whole facilitates this condition of affairs. The human body has a remarkable power of resistance to the results of dental disorders, and this resistance will naturally also find an expression in a pronounced capacity of tolerating dental treatments of very varying quality. Patients not being able to distinguish between relatively good and bad methods of treatment, taught and familiar with the notion that, anyhow, some treatment must be gone though, will submit to operations, the effects of which an accurate examination might have disclosed as being without the result imagined. Unless such investigations are performed and made known to all engaged in active teaching of orthodontics it seems probable that the periodical resurrection of ineffective or needlessly complicated methods will go on indefinitely.

The oral tissues being able to tolerate a great amount of orthodontic instrumentation, the mechanical type of operator has quite a large field on which to exercise his inventive mind. But until we have accurate knowledge regarding the final effects of our manipulations, we will be groping in the dark, not knowing what we are really doing and imagining that we are attaining wonderful results.

That there are members of our specialty who have this mental attitude is clearly evident from the way in which some men reacted towards the important series of papers, delivered before a Conference of Teachers of Orthodontia, 1923, by Dr. A. Leroy Johnson. In these lectures the biologic nature of the malocclusion problem was forcibly brought to the front.[10] There are, however, members of the profession who not only ignore such an attitude but even rather seem to fear that a scientific investigation of our problems and the deductions which are the result of this will obscure our vision. We find an amusing instance of this in the *Proceedings of the American Society of Orthodontists,* 1923, page 56, where one of the gentlemen present makes the following remarks: "When these men take us into the maze of unfathomable depths of the forest, some one must find the way out." To anybody who has given the subject due consideration it must be evident that it is just the mechanical men who have taken us into the unfathomable depths, and that the only way out of this is the one Dr. Leroy Johnson suggested in his admirable lectures, viz., by studying orthodontics as based on biology, and by using appliances as accessories, and not, as has far too often been the case, regarding the treatment of malocclusion of the teeth as if they were mere technical problems, and in describing what has been effected selecting such biologic terms as seem convenient.

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ORTHODONTIC TREATMENT OF DECIDUOUS DENTURES*

By Charles R. Baker, Evanston, Illinois

THIS discussion will be limited to the period of development in which the full complement of deciduous teeth has erupted, usually at the age of two years, and prior to the eruption of the permanent first molars.

Normal function of the deciduous teeth is generally recognized as an important factor in the development of the dental arches, of the alveolar process and of all tissues connected or associated with the upper and lower jaws. It

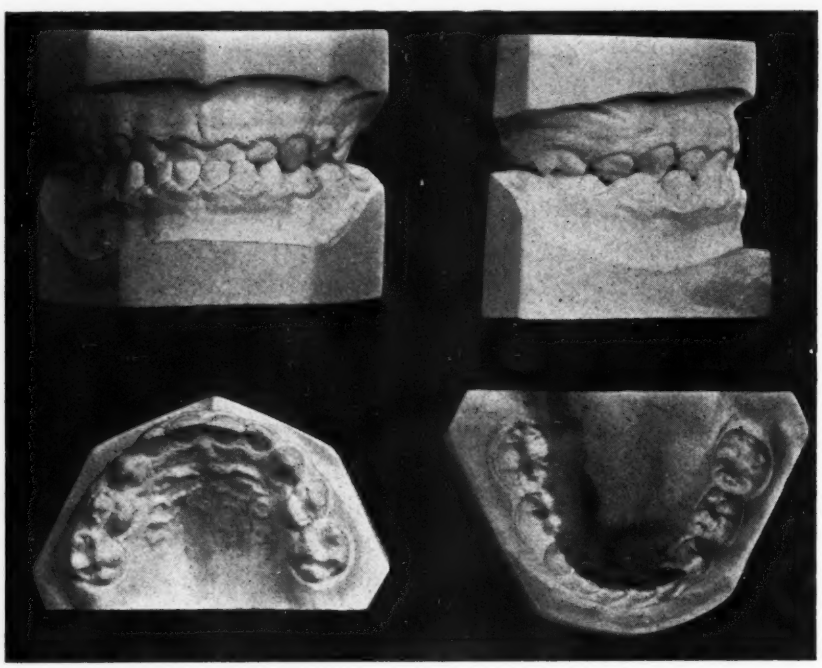

Fig. 1.—Case A. Neutroclusion. A case of abnormal arch form due principally to the linguoversion of the upper anterior teeth.

is also universally understood that the locations of the deciduous teeth and the relationship of the deciduous dental arches influence, to a considerable extent, the corresponding relations of the permanent teeth. In view of these facts, it seems quite evident that orthodontic treatment is indicated in many cases of malocclusion of the deciduous teeth. The statement that orthodontic

*Read before the Twenty-sixth Annual Meeting of the American Society of Orthodontists, Chicago, May 2-5, 1927.

treatment is indicated as soon as malocclusion, or abnormal development of the dental arches is recognized, should apply.

Efforts should be made to prevent abnormal development that might bring about a condition of malocclusion. The individual should receive the proper nourishment, correct as to elements, quantity and diversification. He should be prevented from practicing injurious habits such as sucking the thumb or fingers, using a pacifier or similar article, or practicing posture and pressure habits. Appliances for maintaining space after the premature loss of deciduous teeth and to prevent thumb sucking are sometimes indicated in preventive treatment. Occasionally the grinding of one or more of the deciduous teeth is a desirable and effective method of treatment.

Observations and statistics show that malocclusion during this early period of development is by no means uncommon. The abnormality may con-

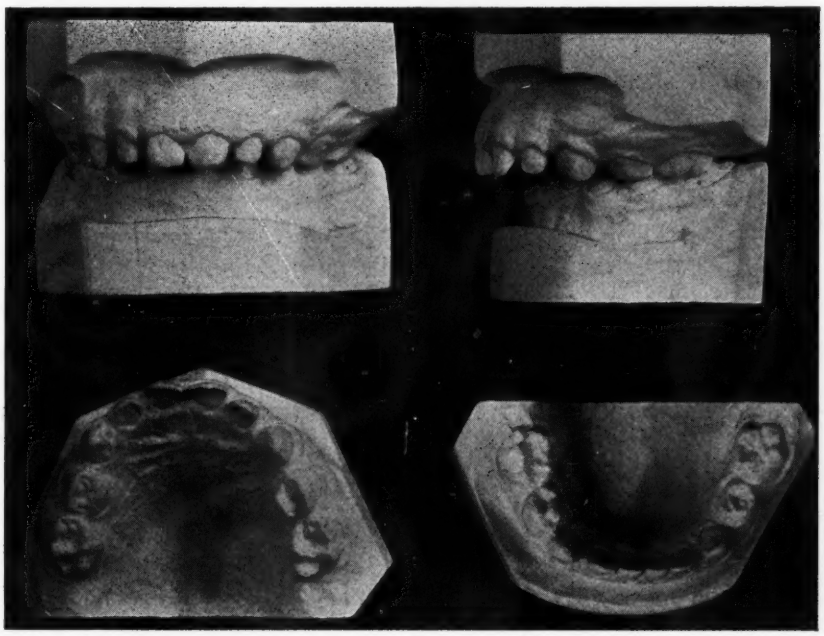

Fig. 2.—Case B. Distoclusion. A case of abnormal arch form and abnormal mesiodistal arch relationship.

sist of one or more of the following characteristics, namely, malocclusion of one or more individual teeth, lack of normal arch form or lack of normal arch relationship.

When a child has reached the age of three years, it is usually possible to apply corrective treatment if necessary, using orthodontic appliances. The most advantageous time for orthodontic treatment of deciduous arches is between the ages of three and four and one-half years, for during this period all of the deciduous roots are fully developed and no absorption of them has occurred. Treatment at this time will also have the maximum influence on the developing permanent teeth and alveolar process. Full mouth radiograms should be used in every case as an aid in diagnosis.

Preventive orthodontic treatment is sometimes indicated to widen deciduous arches prior to the eruption of the permanent incisors.

In case of slight malpositions of individual teeth, corrective treatment is seldom indicated, in my opinion, unless the malocclusion is of such a character as to seriously interfere with the normal function of mastication, which is of such vital importance in a growing child.

Fig. 3.—Case C. Mesioclusion. A case of abnormal arch form and abnormal mesiodistal arch relationship.

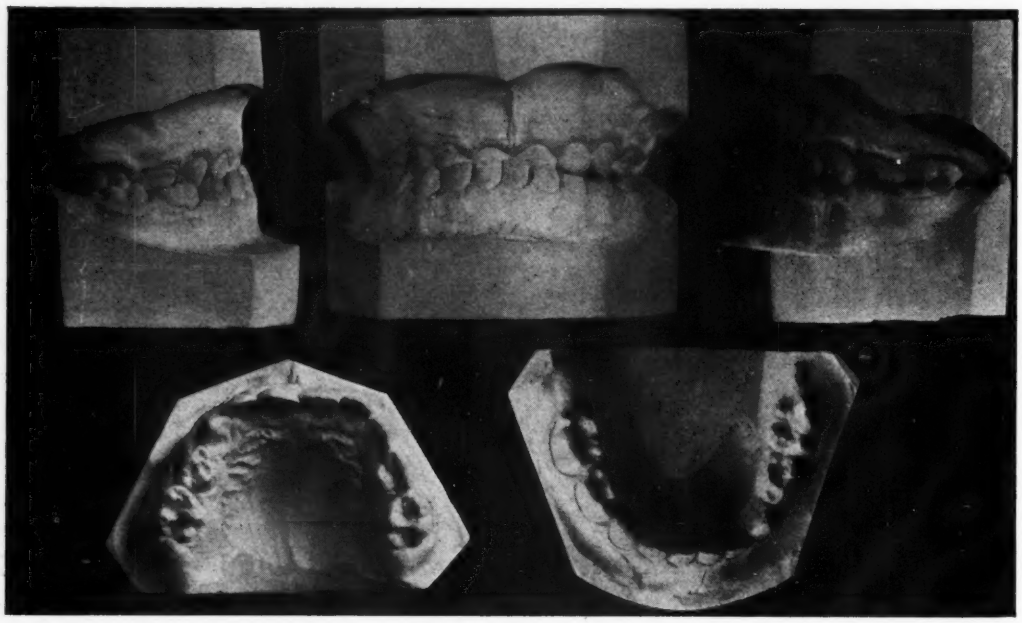

Fig. 4.—Case D. A case of abnormal arch form and abnormal buccolingual arch relationship.

Corrective orthodontic treatment should be applied in practically all cases of abnormal arch form and abnormal arch relationship. This statement is not intended to advise the movement of deciduous teeth if considerable

absorption of the roots has taken place, for under these conditions, the most desirable end-results, as to the development of alveolar process and influence on the succeeding permanent teeth, would probably not be obtained. However, if these cases are treated at the correct time, the length of the treatment period is comparatively short, usually ranging from two to four months, and the results are invariably satisfactory as to occlusion, facial development and influence on the permanent dentures.

The following illustrations show a few cases which, in my opinion, required treatment.

Treatment in some cases may consist of the correction of injurious habits, and the application of muscular exercises, as suggested by Dr. A. P. Rogers, to correct abnormal development. In other cases, the use of appliances is indicated, sometimes supplemented by various exercises. If appliances are to be used, my plan of procedure is about as follows: Plaster impressions are taken and record models made. Impressions in compound are made of the deciduous second molars. Seamless gold crowns are used on these teeth instead of anchor bands. Labial or lingual arch wires are usually indicated, either removable or fixed. If it is possible without materially lessening the efficiency of the appliance, the arch wires, including the labial-arch wires, are soldered to the molar crowns in order to keep the mechanism as simple as possible, even if this necessitates the occasional removal of the appliance for adjustment. Intermaxillary elastics, of such size that a very gentle pressure is applied, are used where indicated. Appointments are usually made about two weeks apart.

For retention, the same appliances are, in many cases, worn for short additional periods.

The results in every case of malocclusion of the deciduous dentures that I have treated, have been very satisfactory. These little children have been splendid patients and the knowledge that I have been able to do something of genuine value for them has been a source of a great deal of personal satisfaction.

DISCUSSION

Dr. P. G. Spencer, Waco, Texas.—Doctor Baker's paper offers very little room for argument. Criticism is sometimes easy to make, but unless constructive, is valueless. The briefness of his paper may have suggested to some of us that it contained little information of value. However, I have read it a number of times, gaining something of value each time.

We have all heard numerous discussions regarding age, length, and time of treatment. With some of us it is an effort to standardize treatment, forgetting that each individual presents a separate problem. Prevention of malocclusion is the ideal desire. A diagnosis must cover considerably more territory than the occlusion of the teeth. For example, mesiocclusions do not just occur at random. There is an underlying factor in a large majority of them that is far removed from incorrect locking of the inclined planes.

Little children are equally as easy to handle as any other case, if we properly gain their confidence, and my only objection is to Doctor Baker's suggestion to always make plaster impressions. Several visits may be necessary to gain their confidence, this is far from being wasted time, yet I do not want to risk the loss of this effort with the ordeal (at least in my hands) of a plaster impression, when such satisfactory results can be obtained with modeling compound. We explain to them the compound's similarity to chocolate ice cream, disguise the taste with application of some pleasant mouth wash, and each one will always

strive to help by biting into the compound when instructed. The lower should always be made first as an additional aid in gaining their confidence.

I have never used crowns instead of anchor bands. However, I am aware a number of men do so, with very satisfactory results. To me it appears it would be more difficult to obtain a proper fit with evidently some trauma during treatment. I find no difficulty in direct band construction for deciduous dentures if we but properly prepare our patient with fairy tales. They are at the imaginative age. Our mallet is an old wood-pecker. We need not cause them one iota of pain, yet curses be upon us if we willfully mislead them.

Space retention as usually applied, is in most cases really harmful. We must not retard growing tissues. Therefore any space retainer must be so constructed that it permits the teeth to which it is attached, ample movement for normal growth.

Deciduous dentures and their treatments are so closely interwoven with the first steps of the permanent denture, that it is difficult to separate them in any discussion. May I be permitted to digress one moment in adding that from observation I believe that a large number of cases are under treatment on account of crowding of the permanent incisors, especially in the mandibular arch, which could frequently be corrected by the proper and timely removal of certain deciduous teeth. The deciduous canine is so often incorrectly removed, instead of the first deciduous molar.

I wish to personally thank Doctor Baker, and assure him I enjoyed his paper very much.

A NEW PAIR OF CALIPERS FOR ORTHODONTIA

Allowing a Three Dimensional Measurement

By Dr. Gustav Korkhaus, Bonn, Germany

THE most modern demands of practical orthodontia are a simplification of appliances which shall exercise their efficiency with regard to the intended movements of the teeth for a longer time. I would only like to mention the "working retainer" of Angle and the "lingual arches" of Lourie and Mershon. Appointments for treatment will be at longer intervals (about every fourth or sixth week) and the practitioner will have an opportunity to observe the result of his treatment. By comparing the existing state with the original one, he can follow the speed and constancy of the movement of the teeth. He will be compelled to increase the activity of the appliance if the aim is not reached or a too slow progress is found; or decrease the force of the appliance when the jaws have reached a certain transformation. From the measurements taken he may also find it essential to alter the direction of the force of the regulating apparatus if the movements do not correspond with his intentions. As the modern appliance hardly requires any attendance, the sole work of the orthodontist will be the control of the treatment.

The attained transformation of the jaws gained by the treatment can be incontestably and accurately ascertained by taking an orthodontic impression at every sitting (if possible a gnathostatic impression) and, in fact, this custom has been introduced by me at the orthodontic section of the university clinic at Bonn, where in the course of treatment a good number of intermediate impressions have been taken to allow the study of the alterations. It is, however, unnecessary to apply this method at every sitting and in some cases hardly possible owing to the delicate structure of the appli-

ance. The simple measurements taken with the calipers, an instrument described by Korbitz-Partenkirchen, has proved extremely suitable for this purpose. The comparison of the distance between the premolars or the molars is employed for the critical examination of the movement of the teeth in transversal direction, i.e., the expansion or compression. The movements in sagittal direction, i.e., the retrusion or protrusion, will also be obtained by simple measurements with the calipers. As measuring point the groove of a buccal tooth is used, for instance, that of the first molar, and for the anterior parts the mesial corner of the edge of central incisor. This anterior measuring-point is, however, often very indefinite, owing to the impossibility of getting a proper grip with the points of the calipers and furthermore owing to the

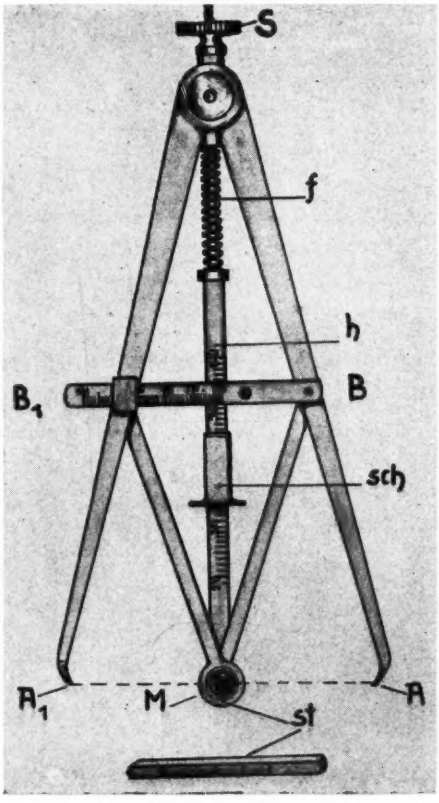

Fig. 1.

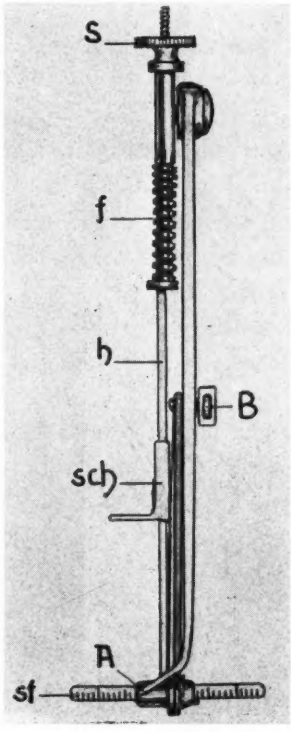

Fig. 2.

great thickness of the edge of the incisor. Also, on account of larger gaps (diastema) or the displacement of the median line, it will be found that the mesial edges of the maxillary incisors do not lie in the median sagittal plane, and consequently other measuring-points must be chosen. As these points displace themselves always in a transversal direction during treatment, different points have to be chosen.

To overcome all these difficulties, and above all, to perform with one single handling all control measurements, a new pair of calipers has proved extremely suitable.

This new instrument is, in its principle, a circle with arms ending in obtuse angles, similar to the Korbitz compasses (Figs. 1 and 2). The opening

of the circle can easily be ascertained by ruler (*BBl*), provided with a scale in mm.; this ruler is movably attached in the center of one arm (*B*) and slides through an also movable passage (*Bl*) in the center of the other arm. At the turning point of the circle a firm husk is attached in the direction of the closed arms. A fine ruler (*h*) runs through this husk and is in the ending point (*m*) connected by two bars (*MB* and *MBl*) with the center points of the arms *B* and *Bl*, also in a movable way. With the help of screw *s*, counteracted by spring *f*, the middle ruler can be shortened—withdrawing the arms symmetrical to both sides—or lengthened—approaching the arms. By virtue

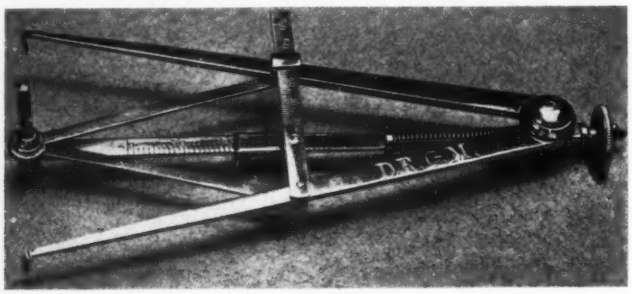

Fig. 3.

Fig. 4.—Control of the treatment by the new pair of calipers.

of this special arrangement of the bars *MB* and *MBl*, which end in the center of the arms of the caliper, and because the bars are half as long as the arms, the point *M* lies always in the center of the straight line formed by the end-points *A* and *Al*. The ruler (*h*) therefore represents in all positions the perpendicular to the straight line formed by these end-points. Beginning from *M* the ruler is provided with a scale in mm. and has a slide with a stopping plate (*sch*).

The point *M* is of a special construction. The center is a square husk through which, in a vertical position to the plane of the circle, a square pin provided with a scale can be pushed.

The handling of the instrument is very simple (Figs. 3 and 4). With help of the screw the end-points of the calipers are brought so far apart that

these points fit into the measuring points on the first molars or first premolars. Then the movable slide (*sch*) is pushed back to that extent that the attached stopping plate fits well to the labial sides of the incisors. Should it be of some interest to follow up the alterations of the gum, then the square pin is pushed through so far that it touches the roof of the mouth. Having made these manipulations, lasting only a few seconds, the calipers can be taken out of the patient's mouth and, without transferring the taken measurements to a centimetric measure, the following items can be read:

1. On the small transversal ruler the distance of molars and premolars;
2. On the middle bar the median distance of the anterior teeth from the junction line of the molars and premolars;
3. On the small square pin the height of the palate in the median region of the molars and premolars.

I am therefore in the position to take a three dimensional measurement with this instrument by one single introduction into the patient's mouth.

Naturally, the calipers can also be profitably used for measurements in the mandibular arch for the examination of the transversal as well as the sagittal movements of the teeth.

If the buccal teeth of an arch have been displaced in consequence of an extraction and are showing a strong asymmetry, the start must be made from the most normal side and a point from the other side, lying in the same transversal line, must be taken. The greatest care must always be taken that the middle ruler lies in the median-sagittal line, irrespectively if the median line of the arch of the teeth is displaced or not.

Should the molars or premolars show great fissure fillings, not guaranteeing the exact grip of the calipers in one and the same point, then a little hole is drilled in the center of the occlusal surface, giving an exact measuring point and allowing a firm grip of the instrument.

THE ORBITAL-CANINE LAW

By Privatdozent Dr. Paul W. Simon, Berlin, Germany

IN THE August, 1927, International Journal of Orthodontia, Oral Surgery and Radiography, C. J. Connolly, of the Catholic University, Washington, D. C., presented an article entitled *Relation of the Orbital Plane to Position of the Teeth*. The purpose of this article was to investigate the accuracy of my proposed "orbital-canine law," and the conclusion was reached that the dentofacial relation which I discovered is not very well founded, the author basing his contention on his findings in the material which he investigated.

Serious objections may be raised against the methods and results of Connolly's investigations, which I shall discuss in the interest of gnathostatic diagnosis—a method of diagnosis of dentofacial deformities in the living, which is not only supported by science, but which has been tried in practice. While Connolly writes of *norm* and *anomaly* as matters of course, in concluding his investigation *variability* is regarded as an inextricable phenomenon. In truth, the latter is the very point where biometric gnathostatics begins and actually makes positive gains for orthodontic practice.

My first objection to Connolly's effort is that he did not investigate the orbital-canine law directly, with the same methods and on equivalent material in which it was found. He went about his task indirectly, with entirely different methods and on very variable material. Moreover, it is not at all difficult to undertake an exact and faultless investigation; but one ought not blame the method if it requires more effort and time than Connolly expended.

The methods of investigation are accurately described in Dr. Lischer's English translation of my book *Fundamental Principles of a Systematic Diagnosis of Dental Anomalies*. One requires a gnathophotostatic equipment, and training and experience in its exact usage. Next, one selects from a community a rather large number of individuals (say 50) who belong to the same racial group, and who possess faultless dentures with anatomically correct occlusion. A gnathostatic cast and photostatic photo are procured from each of these individuals and then the minor portion of the investigation is undertaken: the compilation of the orbital-denture relation in accordance with Quetelet's law. This procedure is described in the appendix of my book. A twofold result may thus be achieved: first, it is possible to construct a binomial curve, and second, the average, or mean, of this curve reveals the orbital-canine relation. Should this ensue, the law is provided for Americans, just as Herzog, I and other authors have established it for Europeans.

Connolly followed an entirely different method; instead of measuring living heads, he used skulls. Measurements on skulls and on living heads are not interchangeable and are in no sense equivalent, but apart from this con-

sideration, which is a fact of minor importance, Connolly did not investigate any relation between the orbital plane and the denture (notwithstanding that the title of his paper produces that impression). He examined the various forms of orbits and the distances of the frontomalare from the zygomaxillare in fifty male and forty-three female European skulls. This material shows a very large variability in fact, which cannot be encompassed in a binomial curve (Rudolph Martin also mentions a "large individual variability of the orbital index"). Now, the craniometry of the orbits is of no special interest to orthodontists, nor can the orbital-canine law be established by such a demonstration. It is readily conceivable that, though the orbits vary considerably in form, their inferior margins may yet bear a relation to the denture as manifested in the *law.*

Furthermore, it seems that the ninety-three skulls were selected without consideration of their pathologic condition. We know that skull-forms may be influenced by various pathologic states; e.g., rachitis. If one follows my instructions in selecting subjects with absolutely faultless dentures, then a certain precaution to procure well-developed skull-forms is already employed. It is generally admitted that the denture is a trustworthy beacon of diseases which influence skull-forms.

In reviewing my methods Connolly committed several errors, which I must correct. I have frequently pointed out that orthodontic diagnosis is not concerned with macerated skulls, but with living heads. Both objects present differences which must be considered; hence the ear-eye plane of the skull is a different plane from the ear-eye plane of the head. We cannot regard skin points as identical with points on the skull. The tragion of the head *corresponds* to the porion of the skull, but is not identical with it. The orbital point on the living is a different point from the craniometric orbital point; therefore, when Connolly says "that the lower orbital points would not always be under the pupils in the living, as Simon implies," he is right, because my orbital point, the cephalometric or gnathostatic, is in fact immediately below the pupil when the eye looks straight ahead. I chose this point after due consideration of certain useful principles; but it is erroneous to contend that I mean the craniometric point which, as is well known, occupies the lowest point on the inferior orbital margin.

This matter seems important enough to me that I am constrained to quote the following passage from my book (p. 90): "To avoid any possible misunderstanding in this important matter, we offer this definition: *The gnathostatic orbital point lies on the* (uniformly very thin, that is, not puffed) *skin at the lower bony margin of the orbit and perpendicularly below the pupil, when the head is in proper balance and the eye is fixed at a point straight ahead.* This gnathostatic, that is, *cephalometric*, point is not identical with the *craniometric* orbital point; the latter lies at the lowest point of the orbital margin and consequently more to one side. The craniometric point is not readily located on the living; but this is inconsequential, because cranial measurements are not interchangeable with measurements on the living."

Connolly falls into a like error when he interprets my orbital plane, for he says, "But another kind of variation would influence its position * * *

this is the angle of the orbits to the Frankfort horizontal; but it may be inclined downward and backward, thus bringing the orbital plane further back." The position of the orbital plane is never influenced by the form of the orbits, or the angle between orbital height and ear-eye plane, because it is always constructed at right angles to the ear-eye plane.

The consummate erroneous manner which Connolly assumes toward this complex question is clearly set forth in his following utterance: "A glance at the table shows clearly that the lower orbital points have not a definite position with respect to other facial parts. Hence, when the lower orbital points are placed relatively low, due to factors we have seen, the orbital plane would pass behind the canines; when placed relatively high, the orbital plane would pass in front of the canines; and in both cases the teeth might be perfectly normal in position."

Toward this attitude I must first reiterate that I have never, at any time, contended that the orbital points presented any fixed position to other skull points; on the contrary, I have always maintained that there are no fixed relations on the skull (or head). Second, however, the orbital-canine law persists; it is, nevertheless, not a phantastic discovery, but the result of definite measurements on a certain living material through the application of biometric statistical methods in accordance with Quetelet's law. I am convinced that Connolly will find quite a number of similar laws, if he will select and investigate his material in a corresponding manner. In textbooks on constitution and heredity one may find a large number of examples of these relations, all in accordance with biologic law.

It is perfectly obvious that, among the many individuals with anatomically faultless dentures who may serve us in an investigation of the orbital law of the canines, the orbital points would naturally present variable positions to the remaining head points. I have not examined the matter, but I regard this as certain and entirely reasonable, and in this respect I am in entire accord with Connolly. Notwithstanding, the orbital-canine relation endures as the biometric mean, and one cannot conclude otherwise than that this relationship is not influenced by the others.

Of course, this fact must not be so interpreted as to mean that in an individual with a faultless denture the orbital plane must pass through the tip of the canine cusp! It appears that certain casual critics of gnathostatics have fallen into this error. Obviously, our relation merely expresses the average of the variation curve. It is always posible, indeed probable, that deviations from this average, variations toward the plus as well as the minus side, are caused by a definite position of the orbital points. We have established that this mean, or average, applies equally to the variability of orbital points, *so that this factor* (the variability of the orbital points) *is excluded from our computations!*

Connolly has misunderstood the import and meaning of gnathostatics; it is based solely on usefulness (compare the appendix of my book: "On the Norm-concept"). He contends that in cases where the orbital plane does not pass through the cusp point of the canines, we are justified in concluding that the orbital points may occupy an abnormal position, and that the teeth are in

normal position. This doubt is entirely intelligible from a purely scientific standpoint, and I flatter myself that I measurably comprehended these contingencies. It was for these reasons that I conducted my investigation of the not very simple, yet logical, and philosophical aspects of the subject, which form the appendix of my book mentioned above. If we accept these purely scientific viewpoints, which always lean toward doubt, we are constrained to ask: how do we know that the orbital points are abnormal, and not the teeth? Connolly may reply that we must investigate the position of the orbital points in their relation to other skull points; e.g., to the upper, or lateral, orbital points, or to the base of the skull. (This is only possible on skulls.) But then I must ask the further question: how do we know that these other points are in normal position? For seventy-five years, ever since Rudolph Virchow made his fundamental contributions, we have known that *constant* or *fixed* points on the base of the skull are unobtainable. If this is true of the base of the skull, then it is even more applicable to other points. One can never end such an argument, or we always end where we began, with variability.

The pure theorist may rest content with such an impasse, though he knows that science must seek further, and more definitely. We poor, practicing orthodontists, however, are always confronted with the fact that in each individual case of dentofacial deformity we must come to a hasty conclusion. Craniometric analyses are of no avail, at least not for our patients. Hence, the useful fiction of our norm-concept is our only aid, to which the orbital-canine law belongs. Formerly, the so-called constancy of the first permanent molar, which Dr. Angle called a law of nature, served us; in truth that was merely a useful fiction in its time. Alas, we have lost this *key to occlusion;* subsequently, a prominent pupil of Angle's, Dr. Oppenheim, of Vienna, found, after a laborious and carefully planned craniometric investigation, that "the first molars do not occupy a fixed, or constant, position." (*Zeitschrift für Stomatologie,* June, 1927.) Thus, the orbital law of the canines must continue to serve us until, sooner or later, a more useful and better fiction is found.

I beg all orthodontists who have any doubts concerning the accuracy and exactitude of this biometric law to take the trouble to investigate it, but in the manner I have indicated above, namely, not craniometrically, but cephalometrically and, if possible, gnathostatically.

THE ORBITAL "LAW" OF THE CANINES

By C. J. Connolly, Ph.D.

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IN HIS note on "The Orbital-Canine Law," Dr. Paul W. Simon of Berlin University, brings no new facts which controvert the results of my investigation; but I wish to call attention to some statements which are misleading and some others which are contrary to fact.

First of all I wish to correct the statement that I presented an article on "Relation of the Orbital Plane to Position of the Teeth" in the August, 1927, International Journal of Orthodontia, Oral Surgery and Radiography. The article was published in the *American Journal of Physical Anthropology* (January-March, 1927) and, at the request of the Editor of the Journal of Orthodontia, reprinted in the August issue of his Journal.

This anthropometric study was occasioned by Dr. Simon's article "On Gnathostatic Diagnosis of Orthodontia" published in the International Journal of Orthodontia, 1924, vol. x, the only paper cited in the text. Neither the German edition nor the English translation of his book *Fundamental Principles of a Systematic Diagnosis of Dental Anomalies* published in 1926 came to my notice until later. I reviewed the book from an anthropometric standpoint in the *American Journal of Physical Anthropology* (October-December, 1927). It has been reviewed from the practical orthodontic point of view in a recent number of the International Journal of Orthodontia. There is nothing in the contents of the book that in any way affect my results.

Dr. Simon's first objection is that I did not investigate the orbital-canine law directly. He says that "measurements on skulls and on living heads are not interchangeable." So far as I am aware, no one ever maintained that they were. But there are various ways of attacking a problem, and sometimes the indirect way proves to be the most conclusive. And by a study of the skull, a very precise way can be used in testing the "Orbital Law of the Canines."

Dr. Simon stresses the use of anthropometric methods. He should remember then, that the Frankfort horizontal is a clearly defined plane through the skull, and that for the living head, the best one can do is to approximate that plane as closely as possible by using certain conventional points. It would be hopeless to expect a more accurate test of his "law" by a study on the living head than on the skull, and no amount of "gnathostatic equipment and training and experience in its exact usage" can ever make good a faulty logic.

Again it is no valid objection that I did not investigate directly the relation between the orbital plane and the denture. This is quite unnecessary. If the level of the base (Frankfort horizontal) is variable, then the orbital plane which is at right angles to it, will likewise vary.

Dr. Simon states further that "It is readily conceivable that, though the orbits vary considerably in form, their inferior margins may yet bear a relation to the denture as manifested in the *law.*" Quite so, and expressed in almost the same language as I used in stating the problem! I said that: "It is well known that the orbits vary considerably in individuals, yet the orbital points, through which the ear-eye plane or Frankfort horizontal passes, might bear a fixed relation to other facial parts." And it was precisely for the purpose of testing this that my investigation was undertaken; and I have proved that such a fixed relation of the orbital points and other facial parts does *not* exist. From the data of my paper, it is obvious that, with the great variability of the orbits, there is no corresponding change in other facial parts. And even in cases where the orbits of two individuals are *identical* in size, the lower orbital points do *not* bear the same relation to other facial parts and consequently to the denture.

Simon says the skulls were selected without consideration of their pathologic conditions. This is a pure assumption. The material consisted of normal average skulls from that part of the collection in the U. S. National Museum from which pathologic skulls are excluded, so that there was no possibility of error here.

Dr. Simon stresses the fact that the gnathostatic orbital point is not identical with the craniometric. The distinction, though important in the application of his methods, is quite immaterial in testing the "law." It is surprising that Dr. Simon does not admit that the angle of the orbits to the Frankfort horizontal would influence the position of the orbital plane. If the lower orbital points, whether cephalometric (on the lower orbital margins, directly under the pupils) or craniometric (on the lowest point of the orbital margin), are deeply inset, the orbital plane is going to lie farther back. In other words, if the orbital height slopes downwards and backwards, the lower points will be farther back, and consequently the orbital plane passing through these points and at right angles to the Frankfort horizontal, will lie farther back. I refer the reader to the second last paragraph of article which is broken up in Dr. Simon's quotations.

In Dr. Simon's discussion on the normal and abnormal points, he again misunderstands the significance of the measurements which I took on the skull. There are, of course, no fixed points on the skull. But one can study relations between points and assume, for the purpose in view, that one is fixed and determine the relation of that point to any other point. In testing the orbital law of the canine, one could just as well take the opposite method to that which I used, and assume that the lower orbital points were fixed. One would then find that frequently, if not generally, the line connecting the lower orbital points with the canines does *not* lie in the orbital plane, which according to definition, is at right angles to the Frankfort horizontal.

I have restricted myself in this study to an anthropometric test of the "Orbital Law of Canines," that aspect only being within my sphere. That this "law" which is likewise a "fiction" may be a useful one, is for orthodontists to decide, as is likewise the question whether Simon's system involves a contribution to the science of orthodontia.

Notwithstanding Dr. Simon's somewhat vigorous statements, which likewise characterize the language of many parts of his book, I have a tolerable acquaintance with the "logical and philosophical aspects" of the subject as treated in the appendix of his book on the *Norm Concept.*

Briefly the norm used as a criterion is the biometric one, and as Simon states, "Our relation merely expresses the average curve of variation." I have shown that so great a variation is found, that there exists, properly speaking, no "Orbital Law of Canines."

THE VALUE OF EARLY AND SCIENTIFICALLY CORRECT DIAGNOSIS OF MALOCCLUSION AS COMPARED WITH EXPERIMENTAL DIAGNOSIS*

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AT FIRST thought, it is probable that few practitioners would take exception to the statement contained in the title of this paper. Yet among those who thus agree, there might and probably would be a wide difference in the diagnosis and treatment of any dozen cases, that might be brought up for consideration.

Making due allowance for individual preference in technic etc., the line of cleavage would show the hundred per-centers, or those who believe every case should be conducted to an ideal conclusion, or if that proves impossible, left to its fate, on the one side, and on the other, those who feel it their duty to give their patient the benefit of the best result possible in his individual case, recognizing that in all cases it may be impossible to attain the ideal according to the standard normal accepted for the race.

The first group appears to believe that patients exist for Orthodontia and are to blame when their case fails to yield to treatment intended, and demonstrated in some instances to bring about ideal results. The second has come to realize that Orthodontia has been developed for the welfare of the patient and that it must accept malocclusions and associated modifying conditions, as they are found and treat them according to the possibilities presented. Hence, the necessity for as early and accurate a diagnosis as possible, that no time may be lost in pursuing the wrong road. I belong to the second group, though in my earlier years of practice, I adhered to the convictions still obtaining in the first. Later, after failures and partial failures, which counterbalanced successes, had convinced me that all cases were not amenable to the same procedure, I arrived at the conviction and expressed it in writing, that no cases except possibly those of some adults, should be treated along lines other than the most ideal, until such treatment had proved unavailing. Then and only then some compromise might be made. And I may say here, that in my case as doubtless in that of many others, it was the excellent results se-

*Read before the Southern Society of Orthodontists, Asheville, N. C., Feb. 28, March 1 and 2, 1927.

cured in these belated compromises, which were forced upon me by a fully demonstrated necessity, that led me finally to the conviction, that it was my duty to my patients to endeavor, as far as possible to adopt the last plan of treatment first, thus avoiding a long tedious and unnecessary period of work, which could only in the end, demonstrate what was not possible in that particular case.

When one reaches this frame of mind, he is sure to be interested in researches, which tend to establish methods of diagnosis which will determine at the out-set the possibilities of the individual case. Perhaps the most able of the recent researches along these lines, has been conducted during the last few years, by Simon. The result of his work is now available in book form. It is perhaps presented in a rather abstruse manner, and for this reason it has seemed hard to understand and to many impractical, but if anyone will give it serious attention, he can easily discover the underlying principles and their application to every day office practice. There are other men working along the same lines and the conviction seems to be general among those who are giving serious thought to diagnosis, that there is still much to be learned in that field and while the Simon method or any other, cannot be relied on to determine with exactness in all cases, the proper location of the denture in the head; it does appear to do so in so many, that it is a favorable check on experience and the use of such a method in conjunction with experience, should enable us to avoid much long tedious treatment, purely experimental in character, and carried on only for the purpose of finding out whether or not a specified case is capable of complete normal restoration, or what is usually regarded as normal, that is, thirty-two teeth with the maxillary and mandibular in the accepted antero-posterior and bucco-lingual relations.

Personally, having only used the Simon method of making gnathostatic models and photographs for the last five or six months, I am in no position to express an opinion, as to whether it will prove a satisfactory and correct method of diagnosis, but it has certainly been enlightening and revealed many unsuspected phases of cases, to which it has been applied. For instance, it reveals the occlusal plane, in its relation to the rest of the head and also locates the antero-posterior position of the maxillary dental arch in the skull with reasonable accuracy. When I say reasonable, I realize that this makes it more difficult for the young and inexperienced practitioner to use, because he has not the acquired judgment to serve as a check on the method which the Author himself does not claim is absolutely accurate, or at least has not been worked out to finality for our conglomerate American race. Yet even in the hands of the novice, combined with the experience of older men, which is available through study and reading, it can prove most helpful.

Some years ago, after many successes and failures and partial failures, a conviction became fixed in my mind, that Class 2: cases, present a distinct problem in Orthodontia and that there might be a possibility of dividing them into two groups; those in which the mandibular dental arch was posterior to normal in its relation to the rest of the head with the maxillary arch normal and those which presented the reverse condition; that is, the maxillary dental arch anterior to normal in its relation to the mandibular and to the rest of the

head. In the latter case, it is evident that ideal treatment would necessitate the retraction of the entire maxillary arch, which of course is a serious undertaking and becomes much more so, when the third molar is present, as we know it to be in nearly all cases.

About this time, I began to take extra-oral roentgenograms of all my cases and have found the third molar usually present, but almost as usually without the prospect of sufficient room to erupt into useful occlusion. If then the maxillary third molar has barely sufficient or even insufficient room to erupt into useful occlusion, with the maxillary dental arch already anterior to its normal position in the skull, how could we expect to retract the whole maxillary dental arch without the removal of either the third molar or some other tooth? Yet I had been constantly trying to do this. Judging by the results, I do not think the percentage of such cases is above twenty or thirty of the class referred to, though I do not claim exactness for the statement. However, I know there are many of them.

In the days before the Baker anchorage or intermaxillary elastics were introduced, such cases and perhaps most of the others also in which the mandibular jaw was distal to normal, were treated by the removal of two maxillary premolars and the retraction of the maxillary anterior teeth. It of course fell short of results, that we can attain to-day by means of intermaxillary force, in most of those cases in which the mandibular jaw is distal to normal, for I firmly believe, as I have stated elsewhere, that bone will develop if not up to its normal size, at least toward its normal size, under Orthodontic stimulation, but it produced so far as appearances were concerned, ideal results; in those cases in which the maxillary dental arch was anterior to normal and as to occlusion, I believe it was better and more serviceable than in those failures which occur, when the treatment adopted seeks to retract the whole maxillary dental arch, for the relapse which is surely to occur, generally leaves the teeth with an end to end occlusion, which is less effective than a closely interdigitating occlusion, even though the maxillary teeth may be one cusp too far forward. But Class 2: cases are not the only ones in which one or both of the jaws fails even with Orthodontic aid to attain ideal development.

I was encouraged by a paper read a few weeks ago in Buffalo, by Dr. George Grieve of Toronto, before a meeting of the Eastern Associates of the Graduates of the Angle School of Orthodontia, in which he said, that after many years of conscientious work, he had come to the conclusion that all individuals did not attain a jaw development sufficient to permit the retention of all thirty-two teeth. He was finding cases, in which it was necesary to reduce the number of teeth, unless the denture was to be conspicuously prominent and out of proportion to the rest of the head. I take Dr. Grieve seriously and so will the many others, who know that it is no lack of ability on his part. There is no man who has a finer technic or can accomplish more in the way of tooth movement or bone development, than Dr. Grieve. He referred to some cases, on which he had labored years to accomplish a result, which he believed would be ideal and which was in so far as the teeth when entirely dissociated from the rest of the face, were concerned. In other

words, models of the teeth looked excellent, but the denture in the face was out of proportion. Of course there will always be cases which we will diagnose as capable of certain development, which will prove failures, because they are especially lacking in developmental possibilities.

There are inhibitions, sometimes, hereditary, sometimes, due to bad or perverted function of the mouth, nose and throat, which will militate against, or utterly prevent the securing of an ideal result. Among them, are cases which are so pronounced that they cannot be stimulated to a size which is even large enough to be in proportion to the rest of the face. Thirty-two teeth in normal occlusion might not be too large for this particular face, but the jaws cannot be stimulated to a sufficient development to permit these teeth to remain in normal alinement and relation, and there are rare cases where even twenty-eight, cannot be so accommodated. In other words, in our civilized race, it is possible for the jaws to be so inhibited in their growth, that the best Orthodontic treatment cannot bring them up to a size which will accommodate all of the teeth, and when in an effort to do this, the teeth are tipped outward and forward, to produce a so-called normal occlusion, a relapse will surely take place, as pointed out by Lundstrom. I do not wish to be understood as contradicting a statement formerly made, namely, that I believe, development can be secured as a result of Orthodontic treatment in all cases, but to restate again that it is a matter of degree.

In this connection I am reminded of a case in which the teeth were so large and the general skeletal development, including the face and jaws, was so small, that I advised the extraction of the second molars, after alinement of the anterior teeth had been secured. I am proud of the appearance of the case to-day, but there still hardly appears room even for the third molars, and I am not absolutely sure that this patient can ever accommodate more than one molar, but as she is only sixteen, I intend to give the third molars every opportunity. I take more pride in the result of this case, than in many in which I blindly insisted on retaining thirty-two teeth. No case may be considered complete, until the third molar problem has been answered nor should it be discharged during any period of the treatment, without advice as to the possibilities of future trouble. Formerly when we discharged patients with twenty-eight teeth erupted and in satisfactory occlusion, and with no knowledge or concern as to what influence the third molar might have later on, the problem was answered in many instances, by a relapse in the alinement of the teeth, due to nature's efforts to make room for the third molar, or with infection about those molars and the intervention of the Exodontist. If he is going to be needed, it is our duty to find it out and advise our patients before our work with the denture as a whole, has terminated.

Another case belonging to Class 1: I began treating at the age of twelve years. This was before the advent of the root movement appliances. Possibly with the pin and tube or bracket band appliances, I might have stimulated bone growth sufficiently to retain all of the teeth. The maxillary laterals were in contact with the maxillary first premolars, and while I succeeded in getting the left maxillary canine into perfectly harmonious relation, I could get, but could not maintain, the right one in this position. The removal of

retainers was always followed by a relapse after each period of treatment, and there were several. The anterior portion of the mandibular arch would collapse, and in the maxillary, the right canine would again be forced labially. Eventually both the patient and I were tired of it and I did not see her for several years, when she returned to know if there was not something I could still do for the prominent right maxillary canine. She questioned if its extraction would not be a great improvement? I had tried out my own ideas several times and she had submitted to it with patience and perseverance, and I knew perfectly well, that the extraction of a right maxillary premolar, would permit me to completely reduce the prominence of the canine. So I had the premolar extracted and the canine was promptly brought into place. The patient and her friends were all delighted and no one would question the great improvement in appearance. So far as the occlusion of the right side was concerned, it was somewhat improved.

I will cite but one other case, which was that of a girl for whom I began treatment, at about nine years of age. She had a Class 2: division 2: case. For a time it seemed the results were good, but as the jaws were forced to make room for the molar teeth as they developed and erupted, difficulties multiplied. After the case was finished as well as possible, there was a period of retention. When the retainers were removed, there was a serious relapse; another period of treatment and another relapse. There was further treatment but discouragement on both sides. I had carried out the ideas of a number of men, expressed in papers, reports of cases, etc. No matter what I did, the approach toward even alinement looked increasingly worse, in this rather delicate and otherwise good looking young woman. I then had a chart made by one of the surveying methods, and did actually bring the teeth into conformity with it. The patient looked worse than ever. The dental arches were simply too big for her mouth and face. On the removal of the retainers, she began to relapse into distal occlusion again and the maxillary arch collapsed once more. Then I had two maxillary premolars extracted, and in less than a year, accomplished more in the way of actual results, than I had in the previous ten. The patient never lived in the city and had given up so much time to the treatment, that she discontinued her trips, as soon as things seemed satisfactory to her. I can now look her in the face, without so much chagrin, as I experienced previous to the extraction.

There will be one-hundred percenters undoubtedly, who will condemn some of the foregoing procedures, but criticisms of this kind that I have listened to, and others which I have read in the Journals, offer no definite counter-solution but indulge in platitudes and conjectures, that have been stock material for many years. I am just as strong a believer in bone development as a result of Orthodontic stimulation as I have ever been, more so if anything, but I also believe as I have stated before, that this development is a matter of degree and is often not sufficient to satisfy the demands of the ideal.

I also want to stress the statement made earlier, that it is our duty to answer the third molar problem, before considering our cases as ready to be discharged from our care. The third molar *is* a problem in the majority of

cases of malocclusion, and it often becomes a problem in cases, which never develop malocclusion at all, until its advent.

In my own mouth a slight malalinement of the teeth has developed into a very considerable one, with the eruption of the third molars. What I went through with in the eruption of these teeth, I would hardly suffer again for any four teeth which I possess, and in spite of the arch crowding itself up to make room for them, they are still located so far back in my mouth, that I have periods when I am constantly annoyed by biting my cheek. There are a vast number of cases, as we well know, even in civilized man, in which the full complement of teeth is developed and erupted at the normal periods, without incident. Many people will tell you they never knew when they erupted their third molars. There are many others whose mouths will easily contain the first twenty-eight teeth in normal occlusion and alinement, and there are still others even though rare, with which we have so often hopelessly struggled, whose mouths do not seem to be capable even of this much development.

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ADDRESS DELIVERED AT A BANQUET OF THE ALUMNI SOCIETY OF THE INTERNATIONAL SCHOOL OF ORTHODONTIA, KANSAS CITY, MO., APRIL 29, 1927

By Dr. Allen H. Suggett, San Francisco, Calif.
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THE subject I am going to talk to you about is orthodontics. It is the science that has for its object the correction of malocclusion, or irregular teeth. It is a new specialty. Although crude attempts were made hundreds of years ago to straighten teeth, yet it is only within the last thirty years that any great progress has been made in classifying and sysematizing it into a scientific system. In fact, it was not until dentists confined themselves to that one branch of dentistry that any material progress was made.

The old procedure was to extract crowded teeth, not realizing that the arches were already too narrow and that by extraction they were only making matters worse. The new philosophy is to expand arches and make room for all the teeth, resorting to extraction only in extreme cases.

We find by examining the skulls of ancient peoples who lived on simple food that required vigorous chewing, and in a time when it was not bad manners to clean your teeth, any and everywhere and at any time, they had good teeth, free from decay and malocclusion.

Our so-called civilization, with its elegant manners, is all very nice, but it makes it necessary, along with a lot of other pests, that you support a swarm of dentists and orthodontists, who might otherwise be doing something useful like cleaning roads or teaching schools.

If you should make a survey of the mouths of the people and see the deplorable condition there presented, and especially among the poor, you

would see that it is primarily a health problem. But it is also an economic problem.

It is a health problem because every mouth with swollen, inflamed gums, abscessed teeth, crowded and irregular teeth that cannot be properly cleaned is pouring infection into the stomach and the blood stream which is carried to every organ of the body.

This infection, in the form of microorganisms, may set up a serious disorder in the heart, or in the joints in the form of rheumatism. In fact, most any organ of the body might break under the stream of poison that is constantly being poured into it.

You must bear in mind that pus from an abscessed tooth carries the same dangerous microorganism that pus from any other part of the body carries; but the medical profession did not until very lately realize the extreme importance of the clean healthy mouth, for every time you swallow you carry whatever infection there is in the mouth into the stomach and on into the blood stream.

When a physician makes an examination now, the first thing he notices is the teeth, and next the tonsils and nose. One of the great internists of Chicago, Dr. Billings, made the statement that the man who could keep this area clean (mouth, nose and throat) had control of the gate that could shut out most of the infections that enter the body.

A specialist on tuberculosis in New Orleans said that he could improve most all patients of T. B. who had clean mouths, but that he had never made any material progress with cases having unfavorable mouth conditions.

The orthtdontist's work is almost entirely with children. Of course all of these children present mouths with crowded teeth. With crowded teeth they cannot chew properly, and they have inflamed, bleeding gums, and abscessed baby teeth. They are pale, anemic and nervous, with enlarged tonsils, and as a sequence they are mouth breathers. The teachers report poor work at school.

Now you will naturally think that a child like this, who has never seen the orthodontist before, would be a terrible problem to solve. Impressions have to be taken, then pictures, then x-rays, and at the next appointment appliances must be cemented in position. Well, it is a problem, but the biggest problem that the orthodontist has to solve is the parents, for they suffer and disturb the child.

The reason the child is no terrific problem to the orthodontist is that he has made it his business to understand children, study their psychology, watch how they react, and not to talk down to them but treat them as an equal and not lie to them. When I say do not lie to children, I mean it absolutely. Many, many times have I had timid little children say, "I am afraid to have you pull that tooth, but you may take hold of it with the forceps—I want to see how it feels." I have done that many times, but I have never violated the beautiful confidence of a trusting child. It would not be decent. I have done everything that Bernard Shaw says that he has done. I have lied, stolen, fished on Sunday, and voted both the Republican

and Democratic tickets, but I draw the line on gaining a little child's confidence and then taking advantage of it.

So I would let loose of the tooth that I was anxious to get out, and wait for the time when the child would get up its courage. Generally that was not very long, and it was worth the wait. The child has gained his own self-respect and he respects others, and a long step has been taken in character development.

Human behavior is a science as exact as chemistry or mathematics. It is as sensative to irritation, stimulation and environment as plant or animal life. If as much study were devoted to human behavior as we give to the study of plants and animals, we would not have so many wars and so much hatred.

I know a man who pays $10,000 a year to the man who has charge of his race horses, but he pays only $60 per month to the governess who takes care of his children. His race horses are a great success.

So we see that the tooth problem is a health problem, but in order to cure it we must be able to get certain treatments carried out, and to do this we must have their hearty cooperation. That means that we must love them and understand them.

It is a social problem because people who are constant sufferers from aching teeth, abscessed teeth, crowded and impacted teeth, do not behave in a normal manner. Aching teeth will drive you almost crazy in one night. You are familiar with some of the results of infection from abscesses. Crowded teeth cause all kinds of nervous conditions, from the ordinary fidgety, irritable, restless manifestations to facial paralysis, serious mental conditions and crime.

The dental problem is a health problem and the health problem is an economic and social problem, for ill health, poverty and crime are very closely related. What kind of behavior can you expect from children or adults who are constantly suffering from abscessed teeth which are so sore that they cannot properly chew their food? They are often afflicted with either constipation or diarrhea. As a result of this they have low resistance and almost a continuous cold, and are ready for any infection that comes along.

In Cleveland and Boston and other cities, they tried the experiment of selecting a group of the toughest "nuts" from the poorest districts and cleaned up their mouths, placed them in healthy condition, taught them how to keep clean and chew their food properly, and the results were amazing. Of course their general health was improved, as well as their school work. Some of them who were incorrigible became normal boys and girls.

There has been enough research done along that line to convince us that ill health is one of the very important factors in crime.

For a number of years a group of men and women from the university have been carrying on various kinds of research work at San Quentin. The various wardens have taken great interest in the work, and I think that we have been instrumental in helping to put in some very scientific social experiments there.

When Johnston became warden he equipped dental offices and arranged an open air ward on the roof for tubercular patients. Every patient was

given a thorough physical and dental examination, and they were found to be suffering from venereal diseases, constipation, ulcerated stomach, eye strain, abscessed teeth, pyorrhea, etc. The warden said that after these conditions were corrected he did not have any bad men—they were a thing of the past. He went so far as to say that these diseases were some of the main causes that sent men there, and concluded by stating, "We have men here who would never have been here if they had had a pair of glasses."

Old superstitions are slowly giving way to scientific reasoning. Most of us believe that every effect has a cause and we are interested in finding out what is the cause of all the strange things that are happening around us. We have gone a long way from the days of witchcraft and the evil eye, but how many are brave enough to sit thirteen at a table, or open an umbrella in the house or start anything on Friday? However, we are a little ashamed of our superstitions, and down in our hearts we believe there is a cause for everything that happens and we can find it if we keep hunting.

We all understand farming well enough to know that we must have good seed and good soil to raise a good crop. We also know that we must have good stock, good feed and the proper environment if we expect to raise good hogs or horses. But still we seem to expect to raise fine men and women from unhealthy fathers and mothers living in slums.

David Starr Jordan said we could better afford to board all the little children in Barbary Coast at the Palace Hotel than we could afford the results of such a place as Barbary Coast. There is where you will find large families of eight to sixteen children, half of them dying during infancy; the rest turned loose on the streets to forage at the age of four or five. They have formed their gangs at seven or eight, and what do you expect them to be at sixteen to twenty-nine?

I examined 500 of these children in the schools, and found shocking conditions. I found many little children with a dirty slice of bacon tied on the face or neck with a filthy rag to cure an abscessed tooth or a sore throat. They flock to the university clinic because they cannot pay for private service so you see it is also an economic problem and it must be solved. It is a part of the great economic social problem of wars, crime and poverty. If we think scientifically, we know that every effect has a cause. Why should not everyone be interested in finding and removing the cause of so much suffering and unhappiness from the world?

When England called her first million men to war, one-third of them were rejected because of their teeth. This was a staggering blow to the government of the world, for if one-third of the flower of the nation, men between the ages of twenty-one and thirty-one, were unfit to go to the front, they surely were not 100 per cent efficient to carry on behind the lines. It was the first time that the fact was driven home that the tooth problem was not only a health problem but a social and economic problem. If it is necessary to take care of the teeth so we can fight better, why is it not equally important in the struggle for existence? If we can take the bodies of the fathers, sons and brothers and put them into the trenches, from which many of them will never return; if we can take the lives of the people for the common good,

why not take the wealth for the common good not only for war but for peace, health and happiness?

We have free schools and free books, but what good are these if we do not conserve the health? It is not even good business to neglect the physical and mental well-being of the people and then have to support them in idleness in hospitals and jails.

The mouths of school children present the usual deplorable conditions, and as a result many of them are losing much valuable time from school. The expense of dental service is beyond most of them, for many of them are not even properly clothed and fed.

Here is the source of the great horde of unfit that rise up against society, and they beget more unfit and more.

REPORT OF THE SEVENTH ANNUAL SESSION OF THE SOUTHWESTERN SOCIETY OF ORTHODONTISTS

THE Southwestern Society of Orthodontists' recent session, December 5-8, at El Paso, Texas, was an entire success. Despite the long trip that each one was forced to make, thirty-eight members were present, which is about 85 per cent of the membership. In addition, the meeting was well attended by members of the El Paso Dental Society. This attendance speaks well for, and shows the progressive spirit of, the Southwestern, and as a side issue emphasizes our high regard for our immediate ex-president and prince of good fellows, Dr. Wm. T. Chapman, of El Paso.

With only one exception, our regular prepared program was presented. Dr. Martin Dewey was our guest, and gave four valuable papers in addition to an address to the local Dental and Medical Societies, and a luncheon talk to the Rotary Club on "The Value of Orthodontics."

Other guests were Dr. H. L. D. Kirkham of Houston, who gave a paper on "Orthodontia and Its Relation to Cleft Palate," and Dr. Harry A. Holder of Nashville, table clinic.

In all, the total of twelve worth-while papers and over sixteen table clinics and case reports were presented, and all will be of practical benefit to us in our every-day practice.

Our afternoon of golf proved the fact that we had the best bunch of "would-be" golfers in the orthodontic profession, Dr. E. F. Woodring with an 82 winning the C. V. Mosby championship cup for the second time (we must head this bird off or he will take permanent possession of it). Dr. T. G. Duckworth copped the golf bag (this was a practical idea on Duck's part, as he has accumulated too many clubs to carry in one bag).

Plans were discussed for a joint meeting of the Southern Society in '29 or '30, final plans and arrangements to be made by the Board of Censors.

Officers elected for the ensuing year were as follows: President, O. H. McCarty, Tulsa; President-elect, E. B. Arnold of Houston; Sec'y-Treas., P. G. Spencer, Waco; Three-year member of Board of Censors, Guy Gillespie, of

Abilene. New members elected are: D. P. Nolding, Albuquerque, Wm. M. Pugh of Wichita, Kans., G. C. Turner, Lubbock, P. J. Murphy of Dallas, Texas, C. D. Stricker, Kansas City, Mo.

The Society is especially appreciative to Dr. Dewey for making our meeting a wonderful success. His presence assured every one that the meeting would be well worth the expense of the trip.

The Society also wishes to thank the advertisers who assisted with the expense of our program, also all firms and individuals who donated a very attractive number of golf prizes. Exceptional hospitality was shown by the local Dental Fraternity in showing us the "Magic River," the Rio Grande dry on one side and wet on the other. While all members were enthusiastic in endorsing El Paso and Juarez as a permanent meeting place, they finally selected Kansas City for the 1928 meeting, to be held just preceding the Buffalo meeting of the A. D. O. Let's get busy and have a trainload out of Kansas City to Buffalo.

Papers presented with discussions will appear in an early issue of the Journal.

P. G. Spencer, Sec.

Dr. C. D. Osterhout, St. Joseph, Missouri, died December 19, 1927. Dr. Osterhout had practiced in St. Joseph for the past two years.

THE REMOVABLE RETAINER (EXHIBIT)*

By Dr. C. A. Hawley, Washington, D. C.

THE principles and methods of constructing and using this retainer have been described in the following papers: "A Removable Retainer," American Society of Orthodontists, St. Louis, March, 1919; "The Problem of Retention," National Dental Association, New Orleans, 1920; "The Principles and Art of

Mandibular with clasps.

Figs. 1 and 2.

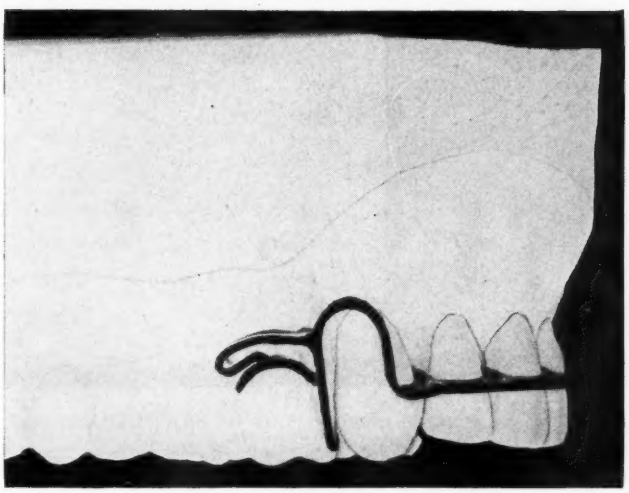

Fig. 3.

*Presented before the First International Orthodontic Congress, New York City, August 16-20, 1926.

Retention,'' European Orthodontological Society, London, August, 1922, and published in the proceedings of these societies.

The photos in Fig. 1 show the maxillary retainer constructed of vulcanite, plain and with a bite-plane, and also of gold.

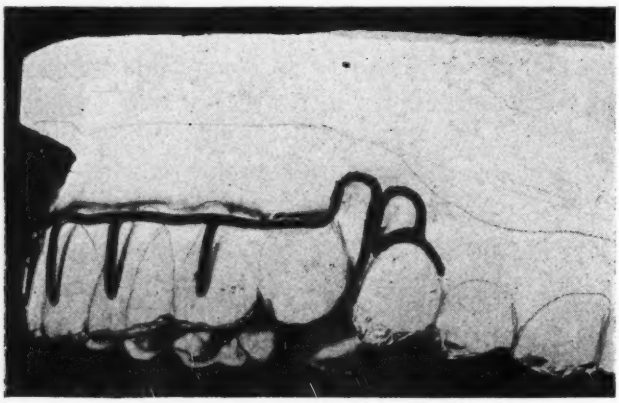

Fig. 4.

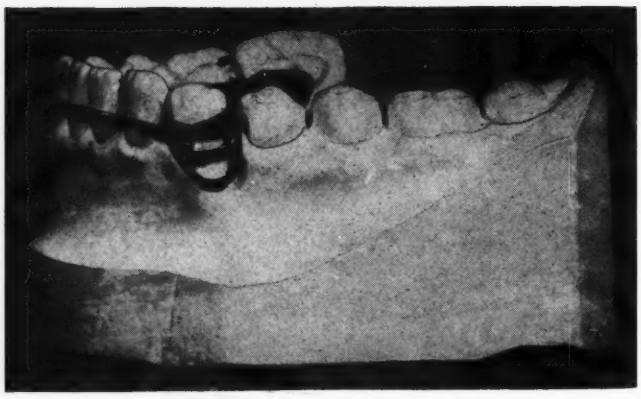

Fig. 5.

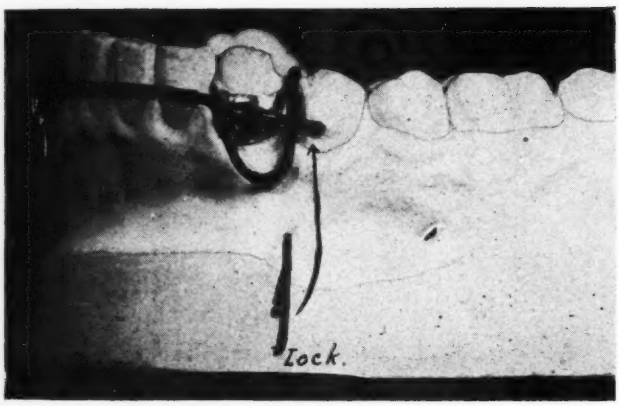

Fig. 6.

Fig. 2 shows mandibular retainers anchored with clasps. Figs. 3 and 4 show form of clasps on maxillary arch, and Figs. 5 and 6 show clasps for the mandibular retainers. These mandibular clasps are not always necessary.

DEPARTMENT OF
ORAL SURGERY, ORAL PATHOLOGY AND SURGICAL ORTHODONTIA

MODIFICATIONS OF ORAL INCISIONS

By Joel M. Zametkin, D.D.S., Brooklyn, N. Y.

Assistant Dental Surgeon, Brooklyn Jewish Hospital, Brooklyn, N. Y.

IN REVIEWING recent literature, both textbooks and periodicals, and while witnessing many operators perform minor oral surgical operations, I have repeatedly noted a casual mention made that "a mucoperiosteal flap is raised." Just how this flap is made, just where the lines of incision are placed, just what direction they are to take, seems somehow or other to have been omitted in most of these articles and demonstrations, or else assumed to have been understood by the reader or spectator, with the result that the demonstrator has merely casually mentioned that a periosteal flap is raised. The minor oral surgical operations that fall well within the ability of the general dental practitioner, and are very frequently performed, are root amputations and alveolectomies. The incision, so far as I have been able to discover, has always been more or less of the semilunar type, the convexity toward the gingival margin, a very narrow strip of mucosa being left. The entire width of this semilunar incision would take in a scant tooth and a half or at the most two teeth in width. Such a flap has many defects. First of all, the field of operation is small, a serious handicap. Second, the flap being so small and of a narrow base, it is difficult to keep safely aside, and incidentally it requires considerable and constant manipulation to keep the mouth of the wound open. The flap, being narrow, is very much limited as to its blood supply, so that there is the risk that the flap might be difficult to keep alive; in fact, it might slough away. The same is true of the narrow gingival band that is left, and to which the flap must be sutured, at the same time jeopardizing the future life of the gingival band because of the small bulk through which the sutures are to be placed. One has but to pick up articles on root amputation, or to look through instrument catalogues to find mention of small spring retractors, the prongs of which are to be inserted into the incision, with the hope and expectation that a wide-mouthed opening will be attained thereby.

From the point of view of work to be done, as well as from the point of view of the healing of the wound, I by far prefer a straight line incision. Straight line incisions heal best and by first intention. They always have a wide base from which the blood supply is furnished, and supplied, not only from one side, but from both sides of the incision and from the two bases. The agglutination is so positive and so firm that the sutures play the comparatively unimportant part in maintaining the edges of the wound for a brief twenty-four hours.

The straight line is better than the semilunar for root amputations performed on two central teeth. The incision should be horizontal, across the roots of the teeth, high up on the gum (the further away from the gingiva the better). The incision should be over the apices of the teeth to be removed, and if made in this manner will leave a very wide gingival band, the future life of which is not jeopardized. The width of the gingival band supplies it with plenty of nourishment and assures sufficient stability to act as a strong mooring against which to suture the other edge of the wound. The incision should take in the width of the two centrals and extend distally to the canines with a slight uptilt toward the apices of those teeth. Such an incision is extremely flexible, very little effort being required to raise the lower flap and very little effort being required to part the incision, which results in a wide-open wound. The gingival band side is left strictly alone, firmly adherent to the alveolar plate, with the exception that a blunt instrument should be passed underneath the margin for not more than one-eighth inch. In other words, a long but extremely narrow flap has been raised. When the incision is sutured back to place, two large stay sutures are applied, one on either side of the frenum, the edges of the frenum having first been carefully approximated. With a small incision it is somewhat difficult to pass the needle through the gingival edges of the incision, it being so firmly adherent to the alveolar plate that one finds it difficult to avoid catching the needle in the margin of the bone instead of sending it directly on its way between the bone and the band. With the band now slightly raised from the alveolar plate, the reader can readily realize the ease with which one can suture the large loose flap, the one toward the buccal fold, to the firmly adherent band at the gingiva. My point is not to discuss suturing, but it is rather to convey the thought that the semilunar incision is full of difficulties together with a liberal risk of slough, whereas this high horizontal long incision obviates all these shortcomings, especially when this added refinement, namely, the long but very narrow flap is also raised, thereby making of the suturing a most simple and sure process. This incision when closed with seven or even nine sutures, enough so that there will be absolutely no gaps, will heal very quickly, leaving an almost imperceptible white line of connective tissue very high up in the gum, almost in the buccal fold. This method allows ample nourishment for rapid and firm agglutination to make the retention of the sutures unnecessary after the second day.

In the surgical removal of roots and teeth with a varying amount of alveolectomy the usual method is to make two vertical incisions, one placed distally and the other mesially to the field of operation, parallel to each other,

beginning at the crest of the ridge and terminating more or less in the buccal fold. The mucoperiosteal flap is raised, the operation performed, and just previous to suturing the flap a segment is removed to accommodate the now smaller surface of the operated field. The removing of this segment causes considerable delay, for the excess flap is removed in a most haphazard manner. It is difficult to hold a loose flap with a mouse tooth forceps in the one hand, and at the same time to cut a straight line with a pair of gum scissors in the other. It is a snipping process at best which results in a scalloped edge of the flap, making ragged margins.

To obviate these difficulties and to make the suturing more simple, I have found the following modifications useful: The distal incision is made by placing the knife point just below the crest on the lingual side of the tooth or teeth, passed buccally over the crest to a level with the gingival margins of the teeth to be removed, then passed downward, distally, into the buccal fold. The mesial incision is begun at the same point, just below the crest of the lingual side, drawn buccally over the crest, down to the level of the gingiva, and then passed downward and mesially into the buccal fold. These incisions run parallel from the lingual aspect to the buccal plate and then flare away from each other as they terminate in the mucobuccal fold, producing a very long base to the flap that is to be raised. Three parallel horizontal incisions are now to be made, the first in the crest of the ridge, running the full length, mesially, distally. The second is made on the buccal alveolar plate, low enough down, the eye having the proper sense of proportion to adjust it exactly right so that it may be later accommodated to the reduced proportions of the operated area. The third horizontal incision is passed mesially distally on the lingual alveolar plate, just above the terminations of the lingual incisions. The mucobuccal flap is now raised, with the result that there are three portions: one very large, which will ultimately be sutured into place, and two smaller segments, the buccal larger than the lingual, both of which when raised are to be absolutely discarded. The periosteal elevator is now passed very slightly under the complete incision margins as they appear. The operation having been performed, the flap is sutured to place across the crest of the ridge, and attached to the partially raised edge of the horizontal lingual incision. The vertical incisions are sutured, passing from the flap to the slightly raised edges of the mesial and distal partially raised incisions. By this technic a very accurate amount of excess tissue may be raised, it being by far easier to cut out this segment while it is still firmly adherent to the buccal plate, resulting in a very straight line and so obviating the snipping process so characteristic of the method previously described. The partially raised edges of all the peripheral incisions make it quite simple to pass the needle from the flap to the point of attachment, it being difficult otherwise to find its point of entry when the mucosa is firmly attached to the alveolar plate. Incidentally, I might also mention that a very wide base is left to the flap, thereby providing an ample blood supply, and with no possible chance of the flap not obtaining the required amount of nourishment. A word description perhaps makes this technic appear formidable, but the procedure is by far simpler than the description of it. It should be tried to be appreciated.

ABSTRACT OF CURRENT LITERATURE

Covering Such Subjects as

ORTHODONTIA — ORAL SURGERY — SURGICAL ORTHODONTIA — DENTAL RADIOGRAPHY

It is the purpose of this JOURNAL to review so far as possible the most important literature as it appears in English and Foreign periodicals and to present it in abstract form. Authors are requested to send abstracts or reprints of their papers to the publishers.

Nutrition and Growth

The Malnourished Child. L. W. Sauer. Jour. Am. Med. Assn., Sept. 17, 1927, lxxxix, 12.

Sauer states that the more carefully each underweight child is studied, the more convincing is the evidence that the condition is usually due to a limited number of causes, and that its correction and prevention are closely associated with the two fundamental requisites for growth—proper food and ample rest.

The importance of a properly adjusted diet, ample rest and restricted daily routine are seldom sufficiently emphasized in the treatment and cure of various otherwise chronic or progressive ailments. The author has obtained good results by the daily use of a special five-meal diet.

A child with anorexia may require exceptional care during the first few weeks of treatment. If the appetite is extremely poor, he should be kept in bed until there is a very definite improvement. Possibly at first only three meals should be given in twenty-four hours (7 A.M., noon, and 7 P.M.). The food should be concentrated and, if necessary, forced.

The author's records show that: (1) Many of the underweight children had been overweight during infancy. (2) Many had been allowed to eat at the family table at an early age. (3) Most of the so-called food idiosyncrasies, about which doting mothers are wont to complain, are imaginary. (4) An asthenic habitus may be outgrown within three months if the weight increases sufficiently. (5) Many had eaten insufficient food for years. (6) Many did not go to bed sufficiently early.

Sauer also states that a nervous environment, premature birth, the inheritance of a small stature, the presence of diseased tonsils and adenoids, too rapid growth in height and lack of cooperation were the most frequent causes of failure of malnourished children to thrive.

Celiac Disease. Sandor A. Levinsohn. Arch. Ped., June, 1927, xliv, 6.

The author gives a good summary of the present conception of celiac disease, first described by Gee in 1888. A pale face with a peculiar expression, which is a mixture of irritability, distrust and fatigue is the typical picture

of "facies celiac." Thin legs and prominent abdomen go with this picture. The distended abdomen which is always present, often persists for years even after cure. Paleness and anemia is a constant early sign. There is usually a delay in the development of the center of ossification. Fatigue is an important symptom. Those children who seem to lack the joy of living are usually obstinate, irritable, vomit easily, and are impossible to please or satisfy. The stools have an intensely putrifying odor, are pale, and of oatmeal mush consistency. The absorption of food salts and water is poor. Achylia and hypermotility are quite constant.

The weight varies with long, slow climb and severe losses, accountable only by disturbance in water and salt metabolism. These children are all hydrolabile, they fail to thrive, and growth is stunted. There are no characteristic findings at autopsy. The period of complete cure is usually at puberty. With such a long drawn out nutritional disturbance of unknown etiology and indefinite pathology, it is to be expected that therapeutic measures are varied and unsatisfactory, and such is the situation with celiac disease. With few exceptions, most authors are convinced of the harmfulness of fat in the diet. Bananas, introduced by Haas in the diet of these children, have gained many supporters.

Cessation of Growth in the Long Bones in Health and Disease. H. A. Harris. Proceedings of the Staff Meeting, Mayo Clinic, Sept. 21, 1927, ii, 38.

Harris states that lines of cessation of growth have been seen in the radiograms of children who have suffered from acute disease. The lines are laid down during a period of cessation of growth in disease, and the dense bone formation is an expression of the degree to which proliferation of the cartilage cells at the epiphyses has been interfered with.

Lines of cessation of growth have been seen in the long bones of stillborn children, so that the growth of the long bones shows the same susceptibility to injury in antenatal as in prenatal life.

In the laboratory experiments, animals have been placed on a water diet for two or three days. On resumption of active feeding Harris found a line of cessation of growth radiographically.

These lines of cessation of growth occur normally in adolescence and normally in the first week of life. They occur in all acute infections and metabolic diseases and in starvation from fetal life to adolescence. This line must not be confused with the line of healing rickets although the latter is really a line of cessation of growth in the sense that it is formed by a readjustment of proliferation, calcification, and ossification in the fast-growing metaphysis.

The lines of cessation of growth in bone are comparable to the ridges in the permanent teeth, in the nails and in the hair. They are comparable to the ridges in the scales of the salmon, in the otocyst of the plaice, and even to the rings in trees. Lines of cessation of growth disappear rapidly at the elbow and wrist in accordance with the strains and torsions involved. They persist longer in the knee and ankle, particularly if the child is bedridden. All lines will disappear on excessive use of the part by reason of

the rapid remodelling of the bone, which is a normal phenomenon. Lines of cessation of growth due to disease in childhood have been seen in middle age. The persistence of a line is an index not only of the severity of the disease, but also of the fact that the patient has not led a very active life in after years. Thus these lines are of significance not only as regards prenatal life but also as regards childhood and adolescence, and they may be of considerable value in the problems of forensic medicine and life insurance.

Studies in Pubescent Growth. Borden S. Veeder and E. H. Rohlferg. Am. Jour. Dis. Child., August, 1927, xxxiv, 2.

During the last six years these authorities have studied the growth of a selected group of boys between the ages of ten and eighteen years, who were in attendance at the St. Louis Country Day School. The pupils come from well-to-do homes, in which they have had the advantage of the best hygienic surroundings and medical supervision since early infancy.

In contrast to the usual percentages, the boys recorded as having poor nutrition average about 3 per cent, dental cases 1 per cent, uncorrected visual defects 3 per cent, etc.

The records of 704 boys were used in this observation. Among other conclusions arrived at by the authors are the following: (1) The average annual growth in weight and height corresponds closely to the figures of previous studies. (2) In group between ten and fourteen years, the gain is fairly evenly distributed throughout the year. From fourteen to eighteen years the gain is chiefly in the period of October and January, inclusive. Little gain takes place in the latter group during the summer vacation months. (3) The period of maximum gain occurred in fall months for 40 per cent, and 25 per cent in the summer months (chiefly in boys under fourteen), and in only 5.5 per cent was the gain fairly uniform throughout the year.

Decline of Operative Dentistry. Editorial in the Dental Cosmos, October, 1927, lxix, 10.

The editor refers to a recent article by the dean of a dental college which appeared in his columns. According to this authority the field of operative dentistry has passed out of dental practice. Dental surgery originated largely with the dentists but the line of advance in modern dentistry appears to be in the direction of restitutions. In general the division of dentistry into different specialties is without reference to operative work. In the past the dentist who operated was called a general practitioner as distinguished from a specialist and with the passing of this general practitioner the operator went with him. Dentistry, once itself but a specialty, is now subdivided into at least seven fields of endeavor, which at least partly explains why operative dentistry has, so to speak, been lost in the shuffle. The editor, however, is inclined to lay the blame for this loss largely upon the introduction of the cast gold inlay. Bridge work, or rather its abuses, proved to be incompatible with aseptic surgical practice and gave the original impetus to the inlay, which was readily accepted and eagerly applied and rele-

gated operative surgery to a subordinate position. The editor is not asserting that operative dentistry has passed into the hands of another group but that it has simply petered out as a field of dental activity.

Seasonal Variation in Growth of Children. Haven Emerson. Proceedings of Section on Preventive and Industrial Medicine and Public Health, Am. Med. Assn., May 20, 1927.

Emerson reports from studies in growth of children in Boston, Toronto and Honolulu. He finds children increasing in weight very slightly, or remaining stationary, or even dropping below their previous weight between December and April.

In many instances infectious diseases, more especially influenza and measles or scarlet fever, developed soon after this loss in weight began. It was not always apparent whether this loss in weight was the cause or the effect of the intercurrent disease, though the impression gained by the curves was that the diseases took hold when the child had been reduced somewhat by possible climatic influences, though the author thought that fatigue was at fault.

In some of the detailed curves there was another slight drop, or lack of increase in the month of August. After that the curve went upward markedly.

Ultraviolet Light in Dentistry. Symposium and editorial in The Dental Surgeon, October 8, 1927.

In this issue the original articles are contributed by Professor Baly, Dr. H. L. Falkner, and Dr. A. E. Rowlett, while the summary is by the scientific editor of the journal. The education of the dentist differs chiefly from that of the physician in being more practical, as he must devote at least two of his undergraduate years in working on the living human subject. But for this very reason he remains somewhat aloof from general treatment of his patient and has not yet been much intrigued by such subjects as light treatment. The rays of the sun are not expected to act on concealed structures like the teeth and there seems no valid reason why they suffer any privation if actinic rays are withheld. Professor Baly who makes this point adds that benefits from the rays if any must accrue to the organism as a whole. Nevertheless, Dr. Falkner, like some other practicing dentists, believes that the local application of the rays may benefit the gums and prove of value in pyorrhea. In this respect they may be compared with vaccines and diet vitamines which benefit dental conditions indirectly by their action on the general economy.

The editor does not allude to Dr. Rowlett's contribution which is summed up by its author as follows: Radiation with the U.V. rays affords a valuable therapeutic means in the treatment of many inflammatory conditions of the mouth but does not take the place of instrumental treatment nor does it do away with the need of antiseptics. It must be visualized as a useful adjunct to the basic methods as shown by the fact that it has shortened the time of convalescence and has turned prospective failures into successes. He has cured no case of pyorrhea with light alone but this has been a great aid to other measures.

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EDITORIALS

Some Facts Concerning the Status of Orthodontic Research

EARLY last Spring, Dr. Albert H. Ketcham wrote letters to several men in the orthodontic profession as well as research workers in the dental profession, calling attention to the importance of investigating certain problems.

Dr. Joseph D. Eby in his presidential address before the American Society of Orthodontists in Chicago, May, 1927, also took up the argument that had been made by Dr. Ketcham and suggested that the American Society of Orthodontists take definite action upon the question of research. As a result of the discussion of this subject, a set of resolutions was adopted by the American Society of Orthodontists at Chicago and were published on page 824 of the 1927 volume of the INTERNATIONAL JOURNAL OF ORTHODONTIA, ORAL SURGERY AND RADIOGRAPHY. In accordance with those resolutions Dr. Walter H. Ellis, the acting president, appointed a committee of five men and suggested that Dr. Ketcham be made temporary chairman. So far as we know,

the committee never has had a meeting due to the fact that unfavorable circumstances have prevented the five men from being at the same place at the same time.

However, prior to the meeting of the American Society of Orthodontists, Dr. Ketcham had carried on some correspondence with various research workers and institutions. He finally outlined a plan whereby the University of California would take up the investigation of certain orthodontic problems, provided a sufficient sum of money could be raised to carry on the work.

Dr. Karl Meyer, head of the Hooper Institute for Scientific Research offered his assistance as director of the investigation with Dr. John Marshall of the University of California actively in charge of the work.

It was estimated that the expense would be three thousand dollars for the first year plus an appropriation of eight hundred dollars which the University of California donated to assist in carrying on this research. The University of California is to be commended on the interest it has taken in this vital problem because it certainly has shown a wholehearted interest, considering the fact that the money appropriated for orthodontic research could very well have been used for other departments of the University. Dr. A. H. Suggett, Professor of Orthodontia in the University of California, undoubtedly used his influence with the authorities to induce them to take this part in orthodontic research. Dr. Guy Milberry, Dean of the Dental School, also became interested and assisted materially.

After the Chicago meeting in May, Dr. J. D. McCoy, Dr. B. Frank Gray, and Dr. A. H. Suggett, organized the orthodontists on the Pacific Coast into an energetic group which became greatly interested in orthodontic problems. Dr. Ketcham told them if they would raise one-half of the three thousand dollars necessary for the first year's work, he would pledge himself to raise the remainder. The fifteen hundred dollars was raised by the boys of the Pacific Coast and deposited with the Treasurer of the University of California. It then became necessary for Dr. Ketcham to raise the other fifteen hundred dollars.

In studying the resolutions as passed by the American Society of Orthodontists, the Research Committee of the American Society of Orthodontists was not allowed to donate any money from the treasury for any reasearch work without its having the approval of the general membership of the Society. Consequently, it became necessary for Dr. Ketcham to ask for donations from the various members of the American Society of Orthodontists; and the sum of fifteen hundred dollars was raised by several men of the American Society of Orthodontists to match the money raised by the boys of the Pacific Coast.

Some of the members of the American Society of Orthodontists might wonder why it was necessary to ask for contributions from individual members when it clearly stated in the resolutions adopted at the Chicago Meeting in May, 1927, that the Committee on Research of the American Society of Orthodontists would use its influence to obtain funds from the Research Commission of the American Dental Association, to be used in carrying on problems of orthodontic research. Some might think the Research Committee of

the American Society of Orthodontists was negligent and not acting according to the resolutions as adopted by the American Society of Orthodontists in May.

Shortly after the meeting of the American Society of Orthodontists, President Ellis appointed the committee referred to, of which Dr. Ketcham was made temporary chairman. Dr. Ketcham, under advice of Dr. Eby and Dr. Ellis, and others, agreed to the plan as outlined in the resolutions; namely, that the Research Committee of the American Society of Orthodontists should place their problem before the Research Commission of the American Dental Association—which was promptly done. Nearly every member of the Research Commission of the American Dental Association expressed himself in favor of the research problem as outlined at that time by Dr. Marshall to be carried on at the University of California. The Research Commission of the American Dental Association had assisted other research work that was being done and had been done by Dr. Marshall and his associates at the University of California. Therefore, it was not necessary for the Research Committee of the American Society of Orthodontists to use much influence to convince the Research Commission of the American Dental Association that Dr. Marshall was qualified to spend any funds that might be entrusted to him for research problems.

However, after Dr. Ketcham had begun a plan which had been endorsed by the past president, Dr. Eby, and the acting president, Dr. Ellis, we were informed that certain members of the American Society of Orthodontists objected to the Research Committee of the American Society of Orthodontists asking for funds from the Research Commission of the American Dental Association, in spite of the fact that the idea at that time had the personal endorsement of the majority of men on the Research Commission of the American Dental Association. We even found that Dr. Ellis, as president of the American Society of Orthodontists—probably under the advice of other members—changed his views and requested the members of the Research Committee of the American Society of Orthodontists to withhold their request for assistance from the Research Commission of the American Dental Association.

At the time of the meeting of the American Dental Association in Detroit, several members of the Research Commission of the American Dental Association, requested a member of the Research Committee of the American Society of Orthodontists to present his formal request for funds as it had already been discussed by the Research Commission of the American Dental Association, and there seemed to be very little doubt that the six thousand dollars asked for originally or part of it, would be granted to the University of California.

It seems to us indeed unfortunate that the President of the American Society of Orthodontists saw fit to stop the action of the Research Committee of the American Society of Orthodontists attempting to secure funds from the Research Commission of the American Dental Association, as authorized in the resolutions adopted by the American Society of Orthodontists in May, 1927. This was particularly unfortunate when so much favorable progress

had been made, as can be proved by letters on file with the Committee. However, Dr. Ketcham, having pledged the fifteen hundred dollars to match the money raised by the boys of the Pacific Coast, proceeded to raise it as has already been stated.

The plan outlined for this research work to be conducted at the University of California will have Dr. Marshall actively in charge of the work with Dr. Meyer as advisor, in conjunction with the committee of orthodontists, composed of Dr. McCoy, Dr. Suggett and other members of the Pacific Coast Society.

It is Dr. Marshall's plan to have four groups of monkeys to be used in this research. One group is to be placed on a normal diet for the purpose of producing normal developments. The second group is to be placed on a deficiency diet for the purpose of studying changes in bone development and tooth formation. The third group is to be placed on a normal diet, upon the teeth of which will be placed various forms of regulating appliances. These appliances will be similar to those used in orthodontic treatment on human patients, and will consist of pin and tube appliances, ribbon arches and bracket bands; also appliances which employ light finger spring pressure. The purpose of this group is to see the effect of orthodontic treatment on the teeth and bones of animals on normal diet, and also to see whether there is any difference in the tissue changes as produced by different types of appliances. The fourth group will be placed on the same deficiency diet as the second group and will have the same type of appliances placed on the teeth as the third group.

Various members of the Pacific Coast Society have volunteered their services in placing these appliances on the animals. The orthodontic staff of the University of California and postgraduate students of that institution will also assist in this work. We believe that this research is as well organized and has been planned as carefully as is possible to plan such an undertaking. Nevertheless, Dr. Meyer and Dr. Marshall and their associates realize the difficulty of carrying on such an extensive investigation and have prepared themselves for any unfavorable conditions which might arise. In order that members of the orthodontic profession who have contributed money for this research might not be over disappointed, should the investigation turn out unsatisfactory, we suggest only a few possible interferences.

In all research problems involving experimental animals—and especially in monkeys—it must be remembered the first difficulty arises in keeping the animals healthy. In the study of diet on monkeys, the problem has not been so much to produce a deficiency diet as to get a diet that would keep the monkeys from getting sick. In order to learn as much about the question as is possible, Dr. Marshall made a trip East during which he talked with all the prominent research men in the eastern cities, regarding the care of control animals. It is a well-known fact among research workers that very often some disease will break out among a group of animals from which they will all die before the experiment is completed. We hope no such unfortunate thing will happen in connection with this attempt toward orthodontic research. However, should such a thing occur, the men interested should not

become disheartened. They should realize these unfavorable occurrences and be ready to start again.

It must also be remembered that research sometimes produces only negative results. For example, with the four groups of animals which Dr. Marshall and his associates are working on, the result might be the same in all groups. This would simply prove that in that lot of animals, diet and orthodontic treatment had not produced the results that had been hoped for. Whether the same result would occur in another group of animals could only be told by carrying on the experiment again. Consequently, the orthodontic profession should be prepared to finance these experiments again in the near future and must also be prepared to raise a similar sum of money to carry on the work next year, regardless of what results may be obtained.

The only way certain orthodontic problems can be solved is to carry on such research work as outlined by Dr. Marshall and his associates, and directed by Dr. Meyer. Dr. Milberry, Dean of the Dental College of the University of California, is cooperating with Dr. Meyer and Dr. Marshall in carrying on this research work.

The Growth of Organized Orthodontia

THE appearance of the fifth edition of the Orthodontic Directory of the World presents evidence of an unusual stimulus on the part of those interested and specializing exclusively in the practice of orthodontics, to form societies. One has but to turn to the list of orthodontic societies and compare it with such a list of even five years ago to realize how great has been the growth of this specialty within the past decade.

The editor of the directory calls attention to the recent formation of societies in Australia and New Zealand and he quotes from a letter from Dr. W. Stanley Wilkinson of Melbourne, who, in writing about the Australian Society, stated "that this society was formed recently and he thinks will be modeled on the lines of the American Society of Orthodontists. At the present time they have only about nine members; all of whom are engaged in the exclusive practice of orthodontics," and he at that time requested copies of the Constitution and By-Laws of both the American Society and the New York Society as a guide in their organization.

Again the editor of the directory quotes from a letter from New Zealand signed by the Honorary-Secretary of the New Zealand Society as follows:

"As a result of the interest inspired by Mr. Donaldson, who attended the First International Orthodontic Congress held at New York City in August, 1926, a Society for the Study of Orthodontics has been formed in New Zealand.

"I take the liberty of writing to you, the President of the Congress, with a view to having our Society included amongst those component Societies recognized in the Orthodontic world.

"Could you let me know what steps are necessary for joining up with other Orthodontic Societies?"

These are indeed encouraging signs and reflect credit on the men who have, by maintaining the high standard in the American Society, stimulated the fraternal relations between the other societies of the world.

It seems almost unbelievable to think that outside the American Society of Orthodontists, which embraces the North American continent, there should be fourteen orthodontic societies in the United States, and all of these with the exception of the various Alumni Societies are practically limited to those in the exclusive practice of the specialty. Turning to Europe we find in addition to the European Orthodontological Society, National Societies in Great Britain, France, Germany and Austria, or a grand total for the entire world of twenty-two societies with a membership of one thousand two hundred and twenty-eight, of whom five hundred and eighty-nine are in the exclusive practice of the specialty.

Not two years have passed since the Orthodontic Congress, yet there have come into existence since then the Chicago Association of Orthodontists, the Virginia State Orthodontic Society, the Austrian Society and now the Australian and New Zealand Societies. These last two societies from such a great distance have already made inquiries regarding a Second International Orthodontic Congress and the requirements for membership in it, with the request that they be included in this next great meeting.

In summing up this growth of organized orthodontia, we believe that we should give due credit to the early pioneers in the specialty who, under the leadership of Dr. Angle (now nearly thirty years ago), organized the first orthodontic society, which for many years was to be the only orthodontic society in existence, and which, because of the high standards maintained throughout these years by the older men in the specialty, has been the example and the model upon which all other societies have been organized, and the high standard which all of the other societies endeavor to emulate.

—*William C. Fisher.*

ORTHODONTIC NEWS AND NOTES

The American Society of Orthodontists

Preliminary Report of Program

The next annual meeting of the American Society of Orthodontists will be held in Buffalo, New York, April 30, May 1, 2, and 3.

The various officers of the Society are working in unison to bring about an attractive and interesting program for this meeting. The program is practically completed at this time; however, it is not in shape for publication on account of various minor changes which are being made. There will be a round table similar to the one held in Chicago last year for the discussion of various informal topics pertaining to the practice of orthodontia. There will also be competitive clinics in accord with the precedent as established a year ago. There will be an essay pertaining to the field of the endowed dental infirmary in orthodontic education. There will be an essay on orthodontic bibliography. There will be a most complete and detailed essay pertaining to the modern and very popular lingual appliance. There will be a report of scientific research as being conducted by some of the members on the subject on bone growth and the physiologic progress of the bone centers of the hands of normal children.

Not the least, there will be recreation. A trip to Niagara Falls, a motor trip down the river, luncheon at the Country Club, golf and sight-seeing, a banquet, and entertainment for the ladies.

The Eastern Association of Graduates of the Angle School of Orthodontia

The annual meeting will be held at the Hotel Vanderbilt, Park Avenue and 34th Street, New York City, on Monday and Tuesday, May 14 and 15, 1928.

E. Santley Butler, Secretary,
576 Fifth Avenue,
New York City

Southwestern Society of Orthodontists

The Eighth Annual Meeting of the Southwestern Society of Orthodontists will be held in Kansas City, Mo., April 27 and 28, 1928. At close of the meeting members will go in special cars to the American Society of Orthodontists' meeting in Buffalo. A special invitation is extended to Rocky Mountain and Pacific Coast Societies to attend our meeting and continue with our party to Buffalo.

Write Dr. Hugh G. Tanzy, Commerce Building, Kansas City, for proper routing of your ticket from Kansas City to Buffalo.

P. G. Spencer, Secretary,
1407 Amicable Bldg.,
Waco, Texas

New York Society of Orthodontists

The annual meeting of the New York Society of Orthodontists will be held on Wednesday morning and afternoon, March 14, 1928, at the Hotel Commodore, New York City.

All ethical members of the medical, dental and allied professions interested in the study of orthodontics are cordially invited to attend.

Programs on request.

William C. Fisher, Secretary,
501 Fifth Avenue,
New York City

Southern Society of Orthodontists

The annual meeting of the Southern Society of Orthodontists will be held at The Southern Hotel, Baltimore, Maryland, on April 27 and 28, 1928. A cordial invitation is extended to all ethical members of the dental and allied professions.

Oren A. Oliver, Sec'y-Treas.,
1101 Medical Arts Bldg.,
Nashville, Tenn.

The Dental Society of the State of New York

Preliminary Program

The 60th Annual Meeting of the Dental Society of the State of New York will be held at the Hotel Syracuse, Syracuse, N. Y., on May 16, 17, and 18, 1928.

Literary exercises, clinics, exhibits, etc., will be held at the Hotel Syracuse. Dr. Daniel Jutton, 405 E. Fayette Street, Syracuse, N. Y., is chairman of the Exhibits Committee. Dr. I. J. Silverman, 541 E. Genesee Street, Syracuse, N. Y., is chairman of the Clinic Committee.

The Executive Council will convene, for the transaction of the business of the Society, on Tuesday, May 15th, at 3:00 P.M.

Essayists.—Dr. Edward C. Kirk, Philadelphia, Pa.; Dr. Chalmers J. Lyons, Ann Arbor, Mich.; Dr. William E. Harper, Chicago, Ill.; Dr. R. H. Volland, Iowa City, Iowa; Dr. M. M. House, Whittier, Calif.; Dr. Edward Kennedy, New York City.

During the time of the meeting, sessions of the New York State Dental Hygienists Association and the Dental Assistants Association will be held.

Headquarters will be at the Hotel Syracuse and reservations should be made direct with the hotel management. For further information apply to the Secretary.

Dr. A. P. Burkhart, Secretary,
57 E. Genesee Street,
Auburn, N. Y.

La Semaine Odontologique and the Thirty-seventh Congrès Dentaire

La Semaine Odontologique, organized by Le Syndicat des Chirurgions-Dentistes de France and L'Association Générale Syndicate des Dentistes de France and nineteen co-operating dental organizations, will meet with the Thirty-Seventh Congrès Dentaire March 25th to April 1st, at Le Grand Palais, Paris. A number of professional meetings have been held here with success, a room being devoted to this purpose. A number of affiliated societies will hold their meetings at the same time.

On March 29th a banquet will be given at Hotel Continental, to which the ladies will be invited. A reception, followed by a ball, will be given by the Presidents, Messrs. de Croës and H. Villain, March 30. One evening will be devoted to sports and an interesting excursion is being planned that will prove as agreeable as that of last year to Bourget. There will be an exhibit of the most modern dental equipment.

Address all communications to M. Roger Renault, Secrétaire Genéral.

39, Avenue Laumiere,
Paris 19°, France

St. Louis Study Club of Dentistry

The St. Louis Study Club of Dentistry, organized in 1919 for the purpose of teaching advanced dental knowledge to practising dentists, without charge, and in continuous operation since that time, has just completed its tenth annual session. The enrollment of one hundred fifty dentists for this term was the largest since the opening of the institution, which will have a clinic and dinner on Saturday, April 14th, 1928, at the Gatesworth Hotel.

The clinic, which will start promptly at two o'clock, will consist of the following subjects: Dental Ceramics; Fixed Bridgework; Full Dentures; Operative Dentistry; Riza-

dontia; Tooth Form and Cavity Preparation; Dental Roentgenology; Dental Prophylaxis; Conduction and Local Anesthesia; Dental Economics; Oral Diagnosis and Diseases of the Mouth.

Following the clinic, a dinner will be given at 6:30 as a tribute to the instructors by the students. The guest of honor on this occasion, Major John C. Gotwals, Engineer Corps U. S. Army, will deliver a lecture, illustrated by movies, on "Alaska."

A cordial invitation is extended to all the members of the profession to attend this clinic and dinner.

Bulletins, descriptive of the Study Club, may be had by addressing Dr. Frank C. Rodgers, 309 Wall Building, St. Louis, Mo.

Alabama Dental Association

The Fifty-ninth Annual Meeting of the Alabama Dental Association will be held in Birmingham April 10, 11, and 12, 1928.

F. F. Perry, Secretary,
Montgomery, Ala.

Iowa State Dental Society

The Sixty-sixth Annual Meeting of the Iowa State Dental Society will be held in Des Moines, May 1, 2, and 3, 1928.

John Scholten, Secretary,
Cedar Rapids, Iowa.

American Association of Dental Schools

The Fifth Annual Meeting of the American Association of Dental Schools will be held at the Mayflower, Washington, D. C., March 26, 27, and 28, 1928.

DeLos L. Hill, Secretary,
1206 Medical Arts Bldg.,
Atlanta, Ga.

American Dental Assistants Association

The Fourth Annual Meeting of the American Dental Assistants Association will be held in Minneapolis, Minn., August 21, 22, and 23, 1928. General headquarters will be at the Leamington Hotel.

Ruth F. Rogers, Secretary,
Suite 1760, 16 N. Wabash Avenue,
Chicago, Ill.

Notes of Interest

Dr. Allan G. Brodie announces the removal of his offices to the Medical Tower, 31-33 Lincoln Park, Newark, N. J. Practice limited to orthodontia.

Dr. Walter E. Wade announces the removal of his office to 412 Beacon Street, Boston, Mass. Orthodontia exclusively.

Dr. A. Wolfson announces the opening of his office at the Medical Tower, Newark, N. J. Orthodontia exclusively.

Dr. E. Farris Woodring announces the removal of his offices to Suite 816 Medical and Dental Arts Building, Sixth and Boulder, Tulsa, Okla.

Dr. Burt Abell announces the association of Dr. Albert P. Horton, recently of Baylor University, Dallas, Texas, at 443 W. Bancroft Street, Toledo, Ohio, for the exclusive practice of orthodontia.

Dr. Pendleton Jones Thomas wishes to announce that after January first, 1928, his practice will be limited to orthodontia. 27 Jones Street, East, Savannah, Georgia.

Dr. E. Alan Lieban announces the removal of his office to 30 West 59th Street, New York City.